

**HOT SPRINGS NATIONAL PARK
RESOURCE MANAGEMENT PLAN**

JANUARY 1998

Roger Giddings
Superintendent
Hot Springs National Park

for William W. Schenk
Regional Director
Midwest Region

**PROPERTY OF MIDWEST REGIONAL
OFFICE LIBRARY, NATIONAL PARK SERVICE**



IN REPLY REFER TO:

United States Department of the Interior

NATIONAL PARK SERVICE

Midwest Field Area
1709 Jackson Street
Omaha, Nebraska 68102-2571

cc [unclear]
Mark [unclear]
[unclear]

26

D18 (MWSO-NR)

JAN 28 1992

Memorandum

To: Superintendent, Hot Springs
From: [unclear] Regional Director, Midwest Region
Subject: Resource management plan review

The park staff is to be commended for responding to the request for an updated resource management plan (RMP) in a timely manner. The narrative portions of the documents are thorough and well written. There are some spelling errors in the project statement narratives.

The site description, page 11, may be modified to include the Bailey's ecological unit classification and Kuchler's potential natural vegetation community as listed in the inventory and monitoring gazetteer. See attached site sheet.

The discourse on a park-wide archeological inventory is thorough, however, the field time should be doubled to complete the 5500-acre inventory, unless there are plans not to inventory certain slopes or developed areas. Funding needs should be allocated over a 2 to 3 fiscal year period to enable the project to be completed in a reasonable sequence such as archival research, field inventory and testing, and report preparation.

The following comment is in relation to a "revisit" of the RMP scoping process that was conducted in the Midwest Region parks 1990-1994. In light of the recent developments, such as Strategic Planning, an observation has been made that park resource plans are often a diffuse list of projects and not always "linked". Therefore, an effort to state a "vision" of desired park resource condition could help focus and prioritize the sequence of projects that are identified in the existing plan.

There are three major issues identified in the program overview section (page 32): lack of knowledge about parks resources, protect air quality values, and wildlife monitoring and protection. The inclusion of a vision statement for what condition the park staff would want the resources to be in the next 20-50 years would help the park staff implement the strategy of projects to accomplish the goal. Certainly a knowledge of park resources and responses to uses or development is the keystone in the park's strategy. The efforts made to concentrate on monitoring spring flow and temperature with regard to the recharge zone developments is an example of a focused strategy. An example of a strategy might be to indicate which sequence the projects would be completed and how that strategy would be the building block of the remainder of the park's resource management program. In addition, the top 5 to 10 projects may be expanded in more detail.

The recent development (information about thermophilic biota from the spring) is worthy of note in the plan and as a project statement related to the project N-001.001 Monitoring Geothermal Spring Flow Regimes.

The primary resource of the park is the series of springs. The respective project statements are listed as priority 5, 11, and 15 following restoration of home-sites, boundary protection, and control of kudzu. The principle resource for the park should be a higher priority in the resource program. This is not to imply the projects be combined but to consider a coherent strategy that includes monitoring of levels and temperature in addition to the technical assistance request for the water resource program.

Project HOSP-N-004.001. The call for implementing a park-wide IPM plan is commendable. A point to make clear in the project statement is based on the history of buildings which sit vacant for several months/years during rehabilitation, IPM should be encouraged as a tool in everyone's "toolbox" and that IPM can be the subject of routine tailgate safety sessions.

HOSP-N-009.001. Replace the term "gunnited" with "stabilized with a gunnite treatment".

HOSP-N-010.001. The resource basic inventory is related to the vascular plant project and the interdisciplinary or integrated project on geographic information systems. Cited relationships between project statements will help structure a strategy of recommended actions.

HOSP-N-013.001. The development of a fire management plan should cross reference the related project statements such as vegetation management, basic inventories, trail management, sensitive species management, restoration of home sites, etc.

The plan is approved contingent upon the consideration of the above recommendations. Please return a signed cover sheet for our plan and signature.

If there are questions, you may direct them to Rick Klukas, Natural Resource program Leader at 402-221-3603, or Steve Cinnamon at extension 3437.



Attachments

TABLE OF CONTENTS

I. INTRODUCTION	1
Resource Management Objectives	3
II. PRESENT RESOURCE STATUS	5
Natural Resources Baseline Information	5
Natural Resources	9
Cultural Resources Baseline Information	13
Cultural Resources	
Status of Archaeological Sites	14
Status of Structures	17
Status of Objects	19
Status of Archival and Manuscript Collections	20
Status of Cultural Landscapes	22
Status of Ethnographic Resources	23
Cultural Context/Themes	24
III. RESOURCES MANAGEMENT PROGRAM	32
Overview of Current Program and Needs	32
Table 1: Personnel	
Table 2: Natural and Cultural Resources Funding	
Programming Sheet 1: Ongoing and Funded Activities	
Programming Sheet 2: Unfunded Activities	
Project Statements	
HOSP	
Cultural	
Integrated	
Natural	
IV. APPENDICES	

Cultural Resources Documentation Checklist	
Park Cultural Resources Status Summary Charts	
Summary Chart for Archaeological Sites	
Summary Chart for Structures	
Summary Chart for Objects	
Summary Chart for Cultural Landscapes	
Summary Chart for Ethnographic Resources	
Bibliography of References	
Cultural Resources Bibliography (CRBIB)	
Natural Resources Bibliography (NRBIB)	

RESOURCES MANAGEMENT PLAN

HOT SPRINGS NATIONAL PARK

I. INTRODUCTION

The purpose of this Resources Management Plan is to provide a course of action for the continuous protection, management, and maintenance of cultural and natural resources found in Hot Springs National Park. Although the park was established specifically for the protection of the thermal water natural resources, present resource management will focus on all natural and cultural resources where possible. The plan provides a basic framework for management activities which will preserve the natural and cultural resources in accordance with National Park Service standards and legislative mandates. It also details a set of research projects and management priorities that are designed to meet the park's most significant resources management needs. The plan is flexible in that it may be continuously updated, revised, and supplemented in order to meet the changing needs of the park.

The land on which Hot Springs National Park is situated was originally part of the 1803 Louisiana Purchase. By an 1832 Act of the Twenty-Second Congress of the United States, the government reserved from settlement the thermal and salt springs, along with four sections of surrounding land, but settlers nonetheless continued to build bathhouses and residences around the springs. In 1875 the government was forced to reconfirm its jurisdiction over the area in the Court of Claims. In 1877, the Hot Springs Commission was authorized to survey the area, reestablish the boundaries of the reservation, and sell unwanted lots to claimants and other private citizens, thus establishing the permanent Hot Springs Reservation. From this date on, the government closely monitored and supervised the springs and their use by private citizens, guiding their development and protecting their therapeutic qualities. The reservation became a national park in 1921.

The park and its surrounding mountains exhibit a south-central United States pine-oak-hickory forest ecosystem. The park's vegetation, thermal waters, cold water springs, bathhouses and associated cultural features, foot trails, prehistoric and historic novaculite quarries, and general physiography combine to form a 4876.77 acre area (as of February 20, 1997) of resource preservation and interpretation that is under the exclusive legislative jurisdiction of the federal government. Another 672.69 acres are within the park boundary but are not federally owned. The city of Hot Springs, Arkansas, with an approximate population of 33,000, lies immediately outside the park and exerts a significant influence on it.

The hot springs are the primary natural resource of the park, but they have not been preserved in their unaltered state as natural surface phenomena. They have instead been managed to conserve the production of uncontaminated hot water for public use. The mountains within the park are also managed within this conservation philosophy in order to preserve the hydrological system that feeds the springs. The primary cultural resource of the park is the Historic Landmark District of Bathhouse Row, which embodies the culmination of spa development at Hot Springs. The group of eight bathhouses, built between 1892 and 1923, is the last of a continuum of facilities designed to utilize the thermal waters and is one of the few collections of historic bathhouses remaining in the United States. It is the only such spa controlled and developed by the U.S. Government, albeit in conjunction with private entrepreneurs. Contributing to this resource are the mountain trails, drives, fountains, landscaped walks, and formal entrances which were developed by the government to enhance the aesthetic and physical experiences of spa visitors. A final important cultural resource that has received little emphasis in the past is the extensive system of prehistoric and historic novaculite quarries that runs through and beyond the park boundaries.

The *General Management Plan/Development Concept Plan* (June 1986) established the direction of the cultural resources management program as focusing on Bathhouse Row: rehabilitate the Fordyce Bathhouse as the park's visitor center, offer the other vacant bathhouses for private rehabilitation and use under the Historic Properties Leasing Act, develop and manage the Bathhouse Row area as a historic landscape, initiate research and documentation of the other cultural features in the park, and improve interpretation of the thermal spring waters, their public use, and the development of the Hot Springs Spa ethic. Emphases of the natural resources management program were identified as: investigate and protect the recharge area of the thermal springs, evaluate the thermal water use and distribution system, improve vegetation management and restore disturbed areas, research and document the park's natural resources, and improve trails and hiking opportunities. With the opening of the Fordyce Bathhouse Visitor Center in 1989, the first of these goals was realized, but the rest are still current.

The State Historic Preservation Officer is involved in many cultural resources projects; copies of park XXX forms relating to changes to historic elements are furnished to that office for review and comment. The Arkansas Natural Heritage Commission maintains a database listing of species and habitats of special interest; this information is provided to the park for consideration in all management proposals.

Hot Springs National Park is open to the visiting public 24 hours each day. Overnight facilities are readily available in the surrounding community and within the park at the Gulpha Gorge Campground. The park also has several developed picnic areas. Hot Springs National Park is primarily managed as an historic area but includes significant natural resources as well. The two are integrated whenever possible to enhance both cultural and natural interpretation.

RESOURCE MANAGEMENT OBJECTIVES

According to the Statement for Management (1988), the park's cultural and natural resources management objectives are as follows:

"To preserve the integrity of the historic structures, designed landscape, and other cultural resources of the Bathhouse Row Historic District.

"To identify significant cultural resources and ensure their protection.

"To utilize existing facilities and infrastructure to the maximum extent possible without compromising resource values.

"To ensure the preservation of the thermal springs, and protect the entire hydrologic system and the purity of the thermal water.

"To maintain healthy ecological systems.

"To protect and maintain the natural diversity of plants and animals outside of areas managed primarily for cultural resources or developed areas.

"To promote public understanding and appreciation of the park's thermal features, geological and hydrological resources, and ecological communities.

"To foster public awareness of man's use of the thermal spring water and the development of the Hot Springs Spa.

"To orient visitors to park resources and inform them about opportunities in the mountain lands area of the park.

"To ensure that facilities are attractive and well-maintained and that a scenic setting is provided for Bathhouse Row and downtown Hot Springs.

"To provide a full range of traditional bathing services, as well as opportunities to experience the thermal waters in a less formal way.

"To encourage the continued evolution of the spa resort tradition at Hot Springs; update facilities and provide more modern bathing services.

"To ensure that facilities for visitor use and administration are compatible with natural and cultural resource values and that park roads and other transportation systems provide safe, efficient public access in a manner consistent with the protection of resource values.

"To cooperate with other governmental agencies, private organizations, and citizens to ensure the following:

Land use and development in the park and its vicinity do not adversely affect the park's natural and cultural resources.

Facilities and programs within the park and outside it are fully coordinated to efficiently serve the needs of regional and local visitors for information and orientation services, traditional therapeutic bathing services, outdoor recreation, and interpretive services.

Traffic flow, pedestrian access, and parking problems are minimized.

"In cooperation with the city of Hot Springs and the private sector, to provide for appropriate adaptive uses of bathhouses, support the rehabilitation and revitalization of the downtown area, and develop a flood-control strategy along Central Avenue."

As mandated in the Government Performance and Results Act (GPRA), the park has recently developed preliminary park mission goals, but these have not yet been approved.

In order to more effectively accomplish its objectives, the park is divided into four management zones: Historic, Natural, Park Development, and Special Use. The Historic Zone encompasses less than 10% of the total land base, yet requires the most management decisions. It is managed to preserve, protect, and interpret cultural resources and settings significant because of their association with historic persons, events, or periods. Not all cultural resources are placed in this zone; it is applied only to lands with well-documented cultural resources. The Preservation Subzone includes the exterior and landscaping features of the Bathhouse Row Historic Landmark District and the Arlington Lawn area, while the Preservation/Adaptive Use Subzone includes the interiors of the bathhouses and the administration building in order to allow their use and appropriate modification for leasing, public use, or administrative functions.

The Natural Zone includes lands with prehistoric and historic quarry sites that are protected but not actively managed or interpreted, lands of no historic significance, or lands where little or no development will occur. These are managed to conserve natural resources and processes while accommodating visitor uses and experiences that do not adversely affect the natural systems.

The Park Development Zone contains those lands needed to provide support to the park and to the visitor which are not classified as historic/adaptive use (although a number of the structures in this zone are on the List of Classified Structures and have historical significance). It also encompasses areas where development or intensive use has substantially changed the natural environment or historical setting. Within this zone, the Administrative Development Subzone supports park management and operations, including the maintenance facilities and the Reserve Avenue facilities. The Visitor Use/Recreational Development Subzone provides services or recreational opportunities to park visitors and includes the Libbey

Memorial Physical Medicine Center/Hot Springs Health Spa buildings and grounds; the Hot Springs Mountain Observation Tower and its parking lot; Hot Springs and North Mountain overlooks and picnic areas; West Mountain overlooks, parking areas, and trail heads; and Gulpha Gorge Campground, amphitheater, picnic grounds, camping areas, comfort stations, and roads. The Access/Circulation Subzone includes paved park roads maintained by the National Park Service and providing access to park resources or facilities. The Landscape Management Subzone includes Whittington Park.

The Special Use Zone contains areas within the authorized park boundary where land uses by other governmental agencies or private landowners (though compatible with the protection of park resources) are of primary importance, with NPS management emphasis secondary to that of other interests. Within this zone the Private Use Subzone encompasses commercial/retail development, low-density residential development (inholdings), and cemeteries. The Transportation/Utilities Subzone includes underground natural gas line rights-of-way, radio transmission towers, overhead power line rights-of-way, and other lands managed primarily or exclusively for non-park purposes. The Public/Institutional Subzone consists of lands owned by state and local governmental agencies outside the springs' recharge zone and used for purposes compatible with the park (including Hot Springs Rehabilitation Center, DeSoto Park, Hot Springs School District facilities, and the Hot Springs municipal watershed lands).

II. PRESENT RESOURCE STATUS

NATURAL RESOURCE BASELINE INFORMATION

The park currently lacks a thorough inventory of wildlife. It also needs an endangered and threatened plant and animal species survey. There has been limited systematic monitoring of natural resources. Soils, 1:24000 Soil Conservation Survey (SCS) maps, and boundary maps exist and will be entered into the park's Geographic Information System as time commitments allow. High resolution color aerial photography has been obtained and will be converted to digital imagery files for incorporation into the park's GIS system. This imagery can then be utilized to monitor temporal changes in vegetative cover types as well as adjacent land use patterns that might adversely affect park resources. Although the park has limited surface water exposures, overall quality is excellent and doesn't require any mitigation strategy. Cold water springs are exposed to ultra-violet light and ozone before being released for consumption. Monitoring required by the Arkansas State Department of Health is now being carried out in a certified, in-park laboratory by trained personnel. Park management lacks air quality monitoring and information.

The following tables list the park's current status on Inventory and Monitoring of baseline data. Baseline data is described as either meeting or not meeting the minimal standards as established in the servicewide "Standards for Natural

Resources Inventorying and Monitoring," NPS-75. Where it has been identified that baseline information does not meet the minimum standard, a project statement to meet this need has been prepared.

HOT SPRINGS NATIONAL PARK

ASSESSMENT OF EXISTING INVENTORYING AND MONITORING PROGRAMS

Function	Level of Effort	
	Below Standard	Meets Standard
Chemical Inventorying & Monitoring		
Surface Waters	X	
Atmospheric Deposition	X	
Geo-Physical Inventorying & Monitoring		
Natural event records	X	
Develop Maps: Imagery from satellites Topographic		X X
Geology: Geologic Maps Soils		X X
Physical geology, mineralogy and soils: Soil analysis Sediment transport Principle mineral composition Geo-hazards	 X X	 X X
Hydrology: Develop watershed maps Inventory through description: Streams Wetlands Groundwater Measure physical parameters: Temperature Turbidity Stage and discharge	 X X X X	 X X X
Create hydrologic models of surface water	X	

Function	Level of Effort	
	Below Standard	Meets Standard
Meteorology Indicate meteorological parameters: Precipitation Air Temperature Atmospheric conditions (e.g. RH, wind direction, etc.)		X X X
Biological Inventorying & Monitoring		
Historical database	X	
Species: Inventory of vascular plants including distribution Inventory of mammals, birds, fish, amphibians and reptiles including distribution Listing of species that are threatened, endangered, endemic or non-native Distribution map of plant and animal species	X X X X	
Populations: For selected species: Distribution Population size/density/cover Age/state/size class structure Growth/recruitment/productivity/mortality	X X X X	
Communities: Vegetation/land cover map(s)	X	
Integration: Qualitative community descriptions to correspond with vegetation maps	X	
Geography: Location of resources associated with an appropriate base map series and coordinate system Resources mapped accurately to GIS standards	X X	

Function	Level of Effort	
	Below Standard	Meets Standard
Accurate and comprehensive representation of park landscape (e.g. satellite, aerial photography, survey as appropriate)	X	
Human Use		
Event Records		X
Maps:		
Develop maps to indicate present areas of use		X
Develop maps to indicate past areas of use		X
Human Activities:		
Identify each type of activity present (e.g. farming, grazing, residential, recreation, etc.)		X
Quantify the identified activities (e.g. yield/acre, density, number of visitors)		X
Ownership:		
Identify whether ownership is public or private		X
Indicate owner for each area		X
Demography		X
Domestic Animals (e.g. livestock, and others)		X
Legal Matters:		
Cite acts, regulations, policies, etc.		X
Indicate management activities and planning		X
Education Activities	X	
Regional Land Use Planning		X
Other Social Sciences Studies:		
List any human studies taking place		X
List any econometric studies taking place		X

Natural Resources

The Ouachita Mountains are a southern extension of the Ozark Plateau, which forms the only major topographic relief for a vast area of the midwestern and south-central United States. The topography was formed in late Paleozoic times by tremendous geological forces that acted to uplift, fold, fault, fracture, and harden inland seabed sediments. Subsequent erosion has led to the formation of the present ridge and valley landscape. The narrow steep ridges of the Zigzag Mountains, the subrange that dominates here, are capped with novaculite rock outcrops. These outcrops are unique to the Ouachita Mountains, and the finely grained structure of the novaculite is known for its superior quality as a natural whetstone.

The natural thermal springs are the primary resource of Hot Springs National Park. The presence of the hot springs is a result of the unique geology of the area in combination with the present topography. The water is geothermally heated at an unusually shallow depth of several thousand feet. The water then rises through faults in the Hot Springs sandstone formation to emerge from the thermal springs. Through radiocarbon dating, this process has been determined to take over 4,000 years. In relation to the springs' function, park lands are viewed as two interrelated units: the discharge zone and the recharge zone.

The discharge zone is a narrow strip about a quarter mile long at the foot of Hot Springs Mountain where the thermal water emerges from fractures in the underlying sandstone formation. This area has been the focus of human use and intensive development over the years and is now the site of Bathhouse Row and downtown Hot Springs. The springs themselves are largely concealed from modern visitors except for three display areas along the row. The rest of the springs were capped before 1901 to prevent contamination; today, the spring water is diverted into the park's extensive thermal water distribution system.

The recharge zone includes the highly permeable Bigfork cherts and the Arkansas novaculite formation. The largest outcrops of these formations generally occur on the mountain slopes and narrow ridges above 700 feet in elevation. When plotted on a map, they form long ellipses around the valleys drained by Hot Springs and Gulpha creeks in the park, and they extend well beyond the park boundary to the north and east into the upper basin of the South Fork Saline River. Scientific studies indicate that perhaps 50 to 75 percent of the recharge zone is within the present park boundary and encompasses much of the mountain lands area of the park. However, it appears possible that the hydrologic system could be disrupted by the wells within any portion of the system.

U.S. Geological Survey Professional Paper 1044-C, *The Waters of Hot Springs National Park - Their Nature and Origin*, postulated the surface recharge area and the recharge mechanism of the thermal springs. This paper calls for additional studies to validate these hypotheses, involving drilling several deep sampling wells and interpreting results.

The effects on the hot springs resulting from urban development within the Hot Springs Creek valley have not been fully quantified because data about past flows from the springs is of limited value today.¹ About 80 percent of the remaining land in the basins of Hot Springs and Gulpha Creeks is hilly and unsuitable for construction, limiting some of the potential for development that would affect the recharge zone. NPS land acquisitions have reversed or prevented most incompatible development within the park boundary. Outside the park boundary to the northeast, the gentler topography of the upper basins of Gulpha Creek and the South Fork of the Saline River poses fewer natural restrictions to development, but because of the area's relative isolation and the general growth trend to the south, little development has yet occurred.

Numerous studies have been conducted on the springs over the past 150+ years. Monitoring studies were done in 1890, 1902, and by the U.S. Geological Survey in 1921-22. A research project undertaken by the U.S.G.S. and jointly funded with the National Park Service resulted in the most complete geologic/hydrologic study available to date: the 1979 U.S.G.S. Professional Paper 1044-C. More recently, temperature and flow monitoring were conducted by U.S.G.S. in the late 1970s, but a major plumbing overhaul of the springs' flow collection system interrupted the study in the middle of the data collection phase.

Currently the water flow from 23 thermal springs is being collected. Another NPS-funded study is under way. A calibrated weir system was installed in the fall of 1988 to measure the temperature and quantity of 1) flow from the combined collection system into the main storage vault underneath the park administration building, 2) stage (depth) of water in this collection vault, and 3) overflow being "dumped" into the underground creek arch when the storage system is at capacity. This study, if continued over a sufficient time period, will monitor and record the natural water flow conditions and variations, providing management with data necessary to evaluate impacts and proposed uses of the waters. This project will also meet the statutory requirement of Public Law 99-591, sec. 2(b), Department of the Interior and Related Agencies Appropriations Act, directing that agencies "maintain a monitoring program for each significant thermal feature" identified by the Secretary; the park's thermal springs are so identified in the Federal Register. Originally conducted by the U.S. Geological Survey, this study is now operated by the park.

The water quality of all public drinking water (including the cold water springs available for public consumption) is routinely sampled on a schedule approved by

¹ Spring flow estimates were taken during Hunter and Dunbar's 1804 expedition, Major Stephen Long's 1818 expedition, and David Dale Owen's 1860 investigations; they also appear in other early publications through the mid 1900s. While the results may not be adequately comparable with those obtained through modern research design, they were done in accordance with the scientific methodology of their time period and are certainly of some value.

the Public Health Officer in the NPS's Midwest Regional Office. These samples are taken and studied by a licensed, fully trained park employee working in the park's own water monitoring lab, which is certified by the Arkansas Department of Health on behalf of the Federal Environmental Protection Agency. The surface waters, which percolate downward and eventually recharge the thermal springs, are not being routinely monitored for quality. The park experienced a polychlorinated biphenyl (PCB) "scare" in the summer of 1986. In response to a local resident's concern over upstream oil settling ponds used to lubricate rock-cutting saws, the upper Sleepy Valley pond was sampled for chemical analysis. No PCBs were found in pond sediment; minute traces of PCBs were found in fish tissue at a level indicating no cause for concern.

In March, 1985 the Hot Springs Rehabilitation Center requested the use of significant quantities of thermal waters to heat the large Center building. This was the principal factor in initiating a contract study of the use, storage, and allocation efficiency of the thermal waters and the water system by Coury and Associates Inc, Wheatridge, Colorado. Phase I results of the study favor the design and construction of a closed-loop heat-recovery system to 1) supply the required amount of cooled thermal water for the park distribution system, and 2) extract the heat from "surplus" thermal water that is presently exhausted into the underground creek arch once the park's storage tanks are filled to capacity. This heat would then be sold to customers for year-around uses such as domestic water heating. The effects of the loss of the thermal water heat on the creek environment have not been addressed.

The thermal water plumbing system has been rehabilitated and is in good condition. In project phase I (1975) and phase II (1981) the collection system from the spring boxes into the creek arch and on into the 268,000 gallon main collection reservoir underneath the park administration building was replaced. In phase III the collection system underneath the Quapaw and Maurice bathhouses was redone. Phase IV (1986) involved replacement of the thermal water distribution lines along Bathhouse Row. At some future date, the main collection reservoir and 4 associated reservoirs (5,000 to 400,000 gallons each) will require additional rehabilitation. Additional items for improved operation are proposed in the Coury and Associates report.

The most common topographic features of the park are the rocky mountain slopes with their novaculite outcrops and lush creek valleys. These areas support mixed stands of oak and hickory interspersed with shortleaf pine on the more exposed slopes and ridgetops. The forest understory contains flowering shrubs, a wide variety of wildflowers, a rare local chinquapin species (*Castanea ozarkensis*), and occasionally the rare Graves spleenwort (*Asplenium gravesii*).

Although most of the park supports dense forest cover, it is unlikely that there is any virgin timber in the park, with the possible exception of a 150-acre stand of shortleaf pine (*Pinus echinata*) on the north slope of Sugarloaf Mountain. Reputedly this state's finest stand of shortleaf pine, it is registered under the Arkansas

Natural Heritage Program. Even though considerable acreage in the park has been under federal control since 1832, prohibitions on timber cutting were not implemented until the area came under the jurisdiction of the National Park Service in 1916. Most of the lands acquired since 1972 have either been farmed, mined for gravel, logged for pulpwood, or cleared for homesites; many areas are in need of restoration or revegetation.

The park experienced a significant attack by Southern Pine Beetles in 1986. Due primarily to the closeness of residential and commercial timber resources immediately outside the park, control action was initiated. Funding of \$20,000 from U.S. Forest Service Insect and Disease Control was allocated in FY 1987. This amount was totally expended by the end of the summer in 1988; the infestation cycle also essentially went dormant that summer. The Southern Pine Beetle Management Plan is documented in the "List of Related Action Plans" in this Resources Management Plan.

The long history of ground disturbance related to the construction of bathhouses and other facilities, combined with the extensive use of exotic plant materials in formal landscape developments along Bathhouse Row, has produced diverse vegetative communities bearing little resemblance to the native vegetation. A rare blue-green alga (*Phormidium treleasei*) grows in the hot water display springs and fountains along the row; the only other known location of this species in North America is in springs at Banff, Alberta, Canada.

Several formally landscaped areas with a mixture of native and exotic species are located along Central, Whittington, and Reserve Avenues and also along Stonebridge Road. Some areas appear to be relatively natural, but most, such as Whittington Park, the Libbey Memorial Physical Medicine Center grounds, and the NPS facilities along Reserve Avenue, are comprised of lawns planted with native and exotic trees and some shrubbery. The most conspicuous landscape planting in the park is the stately succession of southern magnolia trees lining the east side of Central Avenue along the front of Bathhouse Row.

The park has a variety of developed areas and extensive urban interface with the city of Hot Springs. Manicured trails in the Bathhouse Row Historic District, dirt and gravel trails all around Hot Springs Mountain and West Mountain, and the rougher and rockier Sunset Trail across West Mountain, Music Mountain, and Sugarloaf Mountain to Fordyce Mountain, then southward to Gulpha Gorge, provide attractive and convenient recreational opportunities that are literally immediately available to downtown visitors and residents. Visitor safety is a fundamental concern. The park conducts regular hazard tree inspections in major developed areas and along roadsides twice a year, and trims off or removes the evident safety hazards. The park has acquired an elevated bucket truck for this purpose.

Much of the park's boundary adjoins intensely developed urban residential areas. In general, the much of the boundary is adequately marked (although some areas

need accurate delineation), but with the 1993 boundary change and land acquisition still in progress, boundary survey needs will continue into the future. Now that the park has acquired fee title interest in all of the residential homes in the Sleepy Valley subdivision, a program is underway to remove the man-made impoundments there by destruction of the dams and restoration of the land.

One historic and persistent land problem has resulted from the cutting away of steep hillsides immediately outside the boundary as park neighbors attempt to create level property for commercial development. This lack of lateral support results in loss of park lands through landslides and sloughing of the hillside. In the past this has caused frequent and massive slumping of West Mountain roads, the collapse of Oak Trail on West Mountain, and numerous slides behind buildings on Central Avenue, one of which resulted in the death of a store employee. Currently the problem is most evident behind the Arlington Hotel, the Park Hotel, behind the Burton-Eisele Clinic parking lot, and behind the Exchange Street free parking lots.

Wildlife within the park is typical of the region, consisting mostly of rodents, bats, and other small mammals. Because of the region's mild climate, bird species are varied and plentiful. Aquatic resources are limited to portions of several small creeks and are void of significant game fish. No endangered or threatened animal species are known to live in the park.

CULTURAL RESOURCES BASELINE INFORMATION

The park's cultural resources documentation is deficient in nearly every respect. Although the major planning documents such as the *Statement for Management*, *General Management Plan*, *Development Concept Plan*, and *Interpretive Prospectus* are on file, they are outdated and need revision. Rewriting them is currently not a high priority, since it is anticipated that the GPRA process may change the requirements for these and other planning tools. In the subcategory of "Servicewide Inventories, Lists, Catalogs and Registers," only the List of Classified Structures (LCS) is on file; the National Catalog of Museum Objects is in process. The LCS needs to be updated and augmented. All the current catalog records have been entered into the Automated National Cataloguing System (ANCS), but a backlog of accessioned objects await cataloguing. The Cultural Resources Bibliography (CRBIB) includes Hot Springs documents, but many references which should be included have been left out. Additional structures can be nominated for the National Register of Historic Places, and Cultural Sites and Landscapes Inventories need to be accomplished.

In the area of "Basic Cultural Resource Documents" only the museum's Scope of Collections is current and approved. Ethnographic documents are not needed at this park, but archeological and historic documents are sorely needed. None have been written, although a Phase I of a Cultural Landscapes Inventory (CLI) was completed in 1996.

Among the "Special Resource Studies and Plans," a Collection Management Plan is the only item that is current and approved, and it needs minor updating. Both it and the Collection Storage Plan were approved in 1993, but the latter needs extensive revisions to address the burgeoning archival collections and the issue of appropriate storage for the valuable Maurice stained glass. A Collection Condition Survey would also be useful in dealing with these and other curatorial issues. The Fordyce Bathhouse exhibit plan is still current and approved, as is the Historic Furnishings Report for the Fordyce Bathhouse. However, the park needs to complete a similar report for the Buckstaff Bathhouse. Historic Structures Reports are on file for the park administration building and all the bathhouses, but they are needed for most of the other structures on the LCS. Cultural Landscape Reports are also needed.

Status of Archaeological Sites:

The archeological significance of Hot Springs National Park and vicinity is imperfectly understood at this time. Future research within the park will illuminate the relationship of the human occupation here to the broader prehistoric sequence of the general area.

To date, fewer than 100 hectares (approximately 250 acres) have been officially surveyed for archeological sites in Hot Springs National Park. This represents, at most, a little over 5% of the federally owned land within park boundaries (as of February 20, 1997, federal acreage was 4876.77, and non-federal was 672.69). Park files indicate that 18 archeological surveys and/or excavations have been performed in the park. Not all these surveys resulted in discovery of sites. Within the park 16 sites are officially recorded with state offices. Since none of the sites have been formally evaluated except the Indian Mountain quarry, 3GA22 (described in more detail below), authoritative significance, condition, and impact levels cannot be assigned to any sites at this time. Furthermore, monitoring of these sites is infrequent at present, given the remoteness of some of their locations (off established patrol roads) and insufficient staffing.

Past archeological work has included a 1975 park-wide reconnaissance by Charles Baker of the Arkansas Archeological Survey and numerous *ad hoc* surveys preliminary to development in various sections of the park. These surveys were primarily surface/visual-based, with shovel tests at intervals specified in the *Arkansas State Plan for Historic Preservation*. Excavation was performed at the Ral Spring historic site above Bathhouse Row in March, 1983 (results were published in *The Arkansas Archeologist* in 1996 by archeologist Don Dickson). A 1990 investigation of a small historic site in Gulpha Gorge campground culminated in a 1993 report by James Bradford and Charles Haecker, NPS archaeologists from Santa Fe, but apparently no state survey form was filed.

Much work remains to be done if the gaps in our understanding of park's cultural history are to be filled. No Historical Base Map or Archeological Overview/Assessment exists. A formal Cultural Sites Inventory (mandatory under

NPS-28) has never been compiled for the park; therefore, no data has been entered, as is required, into the CSI's successor vehicle, the Archeological Sites Management Information System (ASMIS) database. A CSI for Hot Springs National Park awaits funding. No Identification, Evaluation, or Data Recovery Studies are underway or contemplated at this time, although several *ad hoc* surveys done prior to park development projects were approved by the Southwest Regional Office in the past few years. When these surveys encountered cultural resources, plans were modified so as not to impact the resources, in accordance with NPS Regional recommendations, and site data was registered with the Arkansas Archeological Survey. No Collection Studies are underway at this time, although Dr. Ann Early of Henderson State University and the Arkansas Archeological Survey in Arkadelphia, Arkansas, examined the park's aboriginal ceramic collection in 1996 in preparation for Native American Graves Protection and Repatriation Act (NAGPRA) negotiations. The Cultural Resources Management Bibliography (CRBIB) kept at Washington was recently updated, but a printout of the most recent version showed that many references should be added, if it is to reflect the full spectrum of published and unpublished manuscripts pertaining to the park. One Special History Study on Bathhouse Row, *Out of the Vapors*, was printed in 1988.

No comprehensive overview of the park's archeological and historical resources exists. Projects that would synthesize extant published and unpublished literature, and that would obtain new information, have been "on hold" for years pending the allocation of requisite funds. Doing a job that meets professional (and mandated) standards will involve significant costs; the project statement for the Archeological Inventory makes this clear. It should be noted that even when all such projects have been completed, the park will need sufficient Protection or Cultural Resource Management staff to maintain archeological resources monitoring.

The only survey done for the specific purpose of inventorying park-wide archeological resources was the one by Charles Baker, mentioned above. Archaeologists in the state understand that it was meant as a reconnaissance, not a complete inventory, despite its title. Baker concentrated his efforts in areas of known sites, watersheds, and along well-marked hiking trails. Sites have been discovered since then as a result of miscellaneous surveys, some by qualified park staff and some by professional archaeologists. Areas investigated during these surveys tended to be somewhat linear, due to the nature of proposed developments that led to the surveys--trail extensions, flood-control tunnels, buried utility lines, etc. Sites discovered in the park thus far date from Archaic and Woodland periods of prehistory through the historic period of the 1900s. The Archaic and Woodland sites are mostly quarries but also include occupation sites 3GA40, 3GA41, 3GA42, 3GA43, and 3GA44 on Bull Bayou, with possible sites 3GA564 and 3GA566 elsewhere. Historic sites (none of which are aboriginal) include 3GA153, the Ral Spring; 3GA567 on West Mountain; a sauna "cave" dug out in the late 1800s, 3GA588 behind Hale Bathhouse (the 1994 report on this was by NPS archeologist Charles Haecker from Santa Fe); 3GA595 in Happy Hollow; and several sets of old foundations northeast of the Ricks Estate area (for

which a state site form was submitted in 1993, but which apparently did not receive a state site number). The Bull Bayou sites were recorded by Charles Baker in 1975. Except for the Hale Cave and Ral Spring, the other sites were recorded by Hot Springs National Park ranger Mark Blaeuer in 1993.

An estimated minimum of ten or twenty sites may rest undiscovered in the park (this figure was submitted to Henry Day at the NPS Santa Fe office in November, 1994, when an estimate was last requested). Bathhouse Row--beneath the hundreds of tons of fill dirt hauled in for landscaping and construction over the years--could be one focus for historical archeological research, keeping in mind that repeated construction there over the past 200 years may have disturbed the context for Native American finds. Several seasonal occupation sites (Native American) may be buried under sediments along watersheds in the park, such as Bull Bayou and Gulpha Creek. In the uplands, more novaculite quarry sites may exist than are presently recorded. Old domestic/commercial sites may comprise an archeological resource category as yet fully unstudied. Historic cemeteries and evidence of their associated communities also exist within the park's current boundaries; one is alleged by "town historians" to be a Civil War skirmish site, and another is believed to be African-American. Large-scale documentary research might reveal locations of several historic sites, given the huge document base preserved in park and other archives; see the "Historic Base Map" project statement for more details about this. This is not to imply that deeply hidden sites should necessarily be the focus of an intensive search, unless development or vandalism threatens them; invisibility often works in favor of preservation. Finally, other sites are known within the park which have never been formally recorded. No site for which the state has not assigned a site number has been entered into the RMP charts.

No recorded archeological sites in the park are on the National Register of Historic Places (Bathhouse Row, a historic district, is a National Historic Landmark). Only one archeological site has been evaluated, the Indian Mountain novaculite quarry complex, 3GA22. The park submitted a 30-page National Register nomination in 1995 on this, but it was not approved. A substantial boundary survey (as well as other work) would be required, and an administrative problem is that it straddles the park's eastern boundary. An archeological problem is that most novaculite quarries, including 3GA22, lack diagnostics. Furthermore, novaculite artifacts recovered from such datable archeological contexts as Poverty Point cannot be traced to a particular quarry, given the imprecision of geological "fingerprinting" methods. Most archaeologists in the state maintain that 3GA22 is eligible at the state/regional level of significance, primarily due to its rich associations with investigators like Dr. William Henry Holmes, a pioneer in American aboriginal lithic technology; therefore, it is categorized in the appended chart as "not evaluated." A sizable section of the site also preserves evidence of historic whetstone mining, which Arkansas State Historic Preservation Office archeologist George McCluskey has said merits serious study also. In fact the park has so many aboriginal and whetstone quarries, that the question of nominating one or more quarry districts should be addressed. Prehistoric quarries are found throughout the Novaculite

Uplift region of the southern Ouachita Mountains, including many near-pristine sites in the adjacent Ouachita National Forest. However, the distribution of novaculite whetstone quarries is much more limited, and the park's extensive whetstone quarries apparently constitute the vast majority of those not in active use--thus preserving evidence of 19th and early 20th century extraction techniques. Quarry sites in the park (consisting sometimes of both prehistoric and historic remains) also include 3GA45 (on Music Mountain), 3GA565 (on Sugarloaf Mountain), 3GA586 (on North Mountain), and 3GA587 (on West Mountain). 3GA22 and 3GA586 contain the most extensive whetstone pitting. 3GA22 has been known for years and was recorded by the Arkansas Archeological Survey in 1969, soon after that organization was formed. 3GA45 was recorded by Charles Baker in 1975. The others were recorded by Mark Blaeuer in 1993 and 1994.

Status of Structures:

Hot Springs National Park has 46 classified structures (which actually represent at least 52 individual structures) within its boundaries, but only nine--eight bathhouses and the administration building--are evaluated specifically as having national significance. These nine structures form the core of the National Historic Landmark District, which includes eight additional classified structures: the Formal Entrance, the men's and women's comfort stations on Bathhouse Row, Maurice historic spring area, the Noble Fountain by the Reserve Street Grand Promenade entrance, the Grand Promenade itself, and the two fountains in front of the administration building.

The administration building and six of the eight historic bathhouses on Bathhouse Row have had technical reports filed detailing their condition as of the mid to late 1980s; all the bathhouses were included in the 1973 *Historic Structures Report* by Cromwell *et al.* Asbestos has been removed from all affected structures in the Historic Landmark District. The administration building and the two Bathhouse Row comfort stations have been completely renovated in the past four years; they have good documentation and are in good condition with a low impact level. Four of the bathhouses--the Buckstaff, the Fordyce, the Superior, and the Hale--are in good condition with a low impact level. As the sole bathhouse in continuous operation since its opening, Buckstaff Bathhouse has always been maintained in good condition. It has fair documentation. Fordyce Bathhouse was restored for adaptive use in the 1980s and opened as a visitor center in 1989. Although it is currently in good condition, it needs constant maintenance. The Superior and Hale have been stabilized for leasing, and the lead paint has been removed from their premises. The Lamar Bathhouse is in poor condition, as are the Ozark and Quapaw Bathhouses; all three have good documentation. Lamar Bathhouse must have its interior lead paint removed, but the procedure will be complicated by the necessity of conserving rather than removing the extensive painted murals in the lobby. Quapaw Bathhouse is receiving some much-needed attention; its roof, dome, and cupola have recently been restored, and removal of lead paint in the building's interior is underway. Stained glass skylights have been removed and stored to prevent their further deterioration. Ozark Bathhouse requires the removal of interior

lead paint, along with exterior wall, window casing, exterior walls and roof repairs. The Maurice Bathhouse has good documentation but is in poor condition with a severe impact level. Deterioration has recently caused the collapse of part of one stairway. This bathhouse, which is in the poorest condition of all the structures, has had a badly leaking roof for several years, but the old roof has now been removed, and a new one is being added. Eventually lead paint will also have to be removed from its interior, but stabilizing the structure should be given a higher priority.

Stevens Balustrade is in poor condition; the Formal Entrance and the Grand Promenade are in fair condition. All three have good documentation; impact is moderate for all three. The Maurice historic spring area has good documentation and is in good condition, as are the Noble Fountain, the ornamental fountain in front of the administration building, and the jug fountain on Reserve Street. All three fountains have good documentation. The fountains and Maurice historic spring area all have a low impact.

The former medical director's residence, one of the oldest buildings in the park, has not been nominated to the National Register of Historic Places but has been identified as eligible for the National Register by the State Preservation Office. It is, however, being offered for lease. It is in poor condition, and the impact level is severe. Among other problems, a leaking roof over the living room has caused the floor to rot, and glass shards from damaged windows have fallen in the past, endangering passersby. Lead paint is also flaking from the walls and litters the hardwood floors. The residence's garage is no longer being used for storage; its condition is poor and ground water frequently floods the floor; its documentation is poor.

Classified stonework structures such as retaining walls, trail shelters, road and trail riprapping, the brick "arch" (actually an old reservoir) behind Superior Bathhouse, and NPS owned structures on the Ricks Estate may need to be rebuilt or at least stabilized. Impact level on all of these structures is unknown, and documentation is poor. The Maintenance Division reports the Hot Springs Mountain Drive stonework and the riprapping along Whittington Creek to be in poor condition; some of the trail shelters have been recently reworked, but others still need attention. The brick reservoir is also in poor condition. NPS owned structures on the Ricks Estate structures are in unknown condition at this time; however, architectural historians at the University of Arkansas are currently at work on a National Register nomination for the entire estate. One Ricks Estate structure on the List of Classified Structures, the Ricks boathouse, collapsed and was removed in 1995, immediately after Level III documentation was carried out by Ouachita National Forest archaeologists on behalf of the park.

Other structures included on the LCS include the buildings in the Whittington maintenance complex, east and west duplexes and garages, West Mountain shelter house, West Mountain Drive, North Mountain pagoda shelter, Oertel trail system, a stone tank house on Hot Springs Mountain, and Gulpha Gorge ranger's residence,

stone walls, and low water crossing. Documentation is poor on all of these structures, but former Denver Service Center architectural historian Laura Soulliere was of the opinion that many of these structures would be National Register eligible under a multiple property nomination. Condition and impacts are unknown.

A number of structures need to be added to the List of Classified Structures; these include the Hale hot cave, native stone features such as overlooks and retaining walls on North and West Mountains, native stone features such as spring catchments, bridges, and retaining walls on numerous trails, the walls along Reserve Street terminating at the medical director's former residence, and such Gulpha Gorge features as the retaining walls on Gulpha Gorge Road and Creek, the remains of the dam and bridges in the campground, and the visitor contact center. They have poor documentation, and their condition and impacts are unknown.

Status of Objects:

The park's curatorial collection of 224,268 catalogued and approximately 190,000 uncatalogued objects includes archival, historical, archeological, geological, biological, and paleontological items. The bulk of the collection is archival, consisting of some 206,388 catalogued objects. Catalog records are also on file for 13,627 historical objects, 409 archeological artifacts, 195 geological samples, 3642 biological specimens, and 7 paleontological specimens. Approximately 45.4% of the collection is still uncatalogued and cannot yet be assigned a condition code; 1.8% of objects in the accessioned collection are in excellent condition, 27.2% in good condition, 24.6% in fair condition, and 1% in poor condition. The objects within each category also follow this pattern, with the exception of paleontology; 71% of this sparsely represented group is in excellent condition, and the rest of the objects are in good condition. As these statistics show, at least a quarter of the objects (and possibly double that number, since many of the uncatalogued objects are in poorer condition than the catalogued ones) may need at least minor conservation. A Collections Condition Survey is needed to evaluate and prioritize the objects for conservation treatment.

All small and medium-sized objects have been placed in customized non-acidic cardboard containers over the last four years. The smallest objects are kept in museum storage cabinets that generally meet National Park Service standards, although a half dozen of the smaller cases lack working locks. Seven map cases hold the entire catalogued map and drawing collection. Documentary, archival, and photographic collections have been rehoused in lignin-free, acid-free, or buffered cardboard storage containers as appropriate and are stored on archival steel shelving units. A few collection objects still stored in the old medical director's residence need to be rehoused; they are discussed in more detail below.

Objects are held in two dedicated storage areas (one on the second floor of Fordyce Bathhouse, and the other a Bally building behind the ranger headquarters on Reserve Street) and several nondedicated areas. None of the latter meet National Park Service curatorial standards for control of environment, access, fire,

or theft. Probably the most notable deficiency in the area of environmental control involves the valuable art glass collection (72 panels) removed from the Maurice Bathhouse in the 1970s and stored uncleaned in acidic plywood containers in the damp basement of the former medical director's residence, which no longer has climate control, fire protection, or control over access by unauthorized personnel. One deteriorating box was removed and its contents placed in an oversize map case in 1995, but the rest of the cases remain where they were placed. A few historic objects and many large geological and archeological specimens are also stored in this building. Eighty archival boxes of catalogued and uncatalogued archival materials are in a former Fordyce Bathhouse stateroom that lacks adequate climate control; the room is locked, but access by unauthorized personnel cannot be controlled. The museum technician's office has become an ad hoc storage area overflowing with items awaiting cataloguing and storage; it functions as a work area as well as an office, but not surprisingly it is too crowded to be very effective in any of those capacities. Because it houses the thermostat for part of the bathhouse, its door must remain open even when the museum technician is away; access is therefore completely uncontrolled.

Environmental stability is also lacking in the exhibit cases; they have no separate controls and must conform to the ambient temperature and humidity. Because control of these factors is inadequate throughout the Fordyce Bathhouse, the nearly 1400 objects in cases and in historically furnished rooms are subject to minor temperature fluctuations and major rapid changes in relative humidity. Electronic dataloggers are used to monitor temperature and relative humidity on all three floors of the Fordyce Bathhouse and in the permanent storage areas, but not in the temporary storage areas.

The temporary storage areas and the Bally building have no fire protection. The permanent storage area in Fordyce Bathhouse has a halon fire suppression system which may be phased out soon. An Integrated Pest Management (IPM) monitoring program is in place and covers most of the furnished rooms.

All of the park's catalog records have been entered into the Automated National Catalog System. The number of catalog records has tripled in size in the last five years, but a backlog of approximately 190,000 accessioned objects still awaits cataloguing. An additional undetermined quantity of archival and other materials needs to be evaluated for possible accessioning, which will add to the cataloguing backlog. The backlog exists in these categories: archeological (approximately 302 objects), archival (approximately 165,000 objects), historical (approximately 25,000 objects), and biological (approximately 30 objects).

Status of Archival and Manuscript Collections:

By far the largest number of accessioned objects in the collection are in this group. Several archives have been catalogued to date. The Hot Springs National Park Administrative Archives consists of the administrative records of the park from 1878 to 1990. This entire archival collection has been microfiched, and a finding

aid is on file for approximately half of it. The original filing order has been preserved.

The William H. Deaderick Documentary Collection is a scrapbook and accompanying materials on drumming from the library of William Deaderick, a former member of the Board of Registered Physicians. This collection has a finding aid, but it has not yet been microfiched.

The Hot Springs National Park Photographic Collection includes stereographs, glass negatives, film negatives, lantern slide transparencies, slide transparencies, mylar transparencies, black and white photographs, color photographs, and photographic postcards. The finding aid on this collection was begun in 1993 and is continuously being updated to include newly accessioned items. The photographic images are gradually being scanned into Corel PhotoPaint for reference by researchers. The archives contains a number of photodocumentary collections:

- * The Historic American Buildings Survey Photodocumentary Collection
- * Photodocumentation of the Restoration of the Fordyce Marquee
- * Photodocumentation of the Creek Arch, administration building weirs, removal of Army-Navy Hospital building no. eight
- * The Hamilton Report (photographic portion)
- * Hot Springs Bathhouse Employees Archival Collection (photographic portion)

The latter also includes oral history tapes; a few have been transcribed, and some have been copied onto audio cassette tapes, but no finding aid has been completed.

The Hot Springs National Park Bathhouse Collection is repositied at the University of Arkansas at Fayetteville. Microfiche for this collection is on file, along with a finding aid written by special collections staff.

The Hot Springs National Park Map, Drawing, and Specifications Archives contains documents spanning some 125 years. Objects in this collection have been microfilmed or microfiched as appropriate, and a comprehensive finding aid (including a detailed subject index) has been written for it. Building specifications are a new addition to the aid, which was initially completed in 1995 and updated in 1996.

Most of the papers left by former bathhouse owner John Rison Fordyce have been scattered throughout the Fordyce family. Some have found their way to the park, piecemeal fashion, and have been catalogued as three separate archives over the years.

- * The John Rison Fordyce Papers, 1880...(1925-1931)...1935, Fordyce papers sent several years ago to the University of Arkansas Special Collections for processing and storage. The collection has a finding aid written by special collections staff members; it will be microfiched in the near future.
- * John Rison Fordyce Papers, 1907-1912, a collection discovered and processed at the park in 1996. This collection has been microfiched, and a

finding aid is on file for it.

* John Rison Fordyce Papers, 1925-1931, another collection recently unearthed at the park. It has been catalogued, arranged, and placed into acid-free folders, but it requires an inventory, microfiche, and a finding aid. Microfiche of a fourth private collection of Fordyce papers is on file; the park is attempting to obtain microfilm of the other Fordyce collection(s?) at the University of Arkansas Special Collections. Other papers belonging to these archives may be found among the uncatalogued objects. Collections in such institutions as Washington University in St. Louis and Northwest Louisiana State University are also known to include Fordyce papers which might be available on microfilm.

Numerous documents acquired and catalogued as manuscripts have been included in finding aids and indexes to aid researchers in accessing them. The Hot Springs National Park Brochure Collection consists of brochures, menus, articles, and promotional items listed in a finding aid arranged by subject and chronologically within each subject; most of the items have been copied onto microfiche. Park reports are also being copied onto microfiche and included in a simple finding aid. A rudimentary finding aid for postcards is underway, and the postcard images will eventually be scanned into Corel PhotoPaint for access by researchers.

Some of the archival and manuscript collections not yet catalogued include notes and papers of several researchers, bathhouse employee personnel records (non-NPS), and Buckstaff Bathhouse archives (only a portion). Because of the new NPS policies and guidelines on archival and manuscript collections recently issued in Washington, a survey and evaluation of all the park's holdings, including those already accessioned, should be carried out as time and funding permit. Methods of processing these objects must be reviewed and revised to conform with the new standards. Archives, manuscripts, and manuscript collections make up nearly 90% of the Hot Springs Collections.

Status of Cultural Landscapes:

In early 1996, Sherda K. Williams and Marla McEnaney (of the Cultural Landscapes Inventory Division at the NPS Midwest Regional Office in Omaha) visited Hot Springs National Park, examining the park and conferring with staff. In Phase I of their Cultural Landscapes Inventory for the park, Williams and McEnaney defined the following component landscapes as having potential to be significant on their own or contribute to a larger landscape:

1. Bathhouse Row and Grand Promenade
2. Hot Springs and North Mountains, including the Oertel Trail System
3. The Hot Springs Rehabilitation Center (former Army-Navy Hospital) area, the majority of which is not NPS-owned or under NPS control; the NPS-owned sections are the duplexes dating from the 1930s and the Army-Navy Gate

4. Libbey Memorial Physical Medicine Center (former Government Free Bathhouse) and Medical Director's Residence
5. Gulpha Gorge Campground
6. The Ricks Estate, much of which is not NPS-owned or under NPS control; the NPS-owned section is the Ricks Pond and Stonebridge area
7. West Mountain (the older sections)
8. The Whittington section of the park
9. Quarry/mining resources (archeological)
10. Maintenance Area (built with Civilian Conservation Corps help)

All the above components fall into the historic designed landscape or historic vernacular landscape categories, or some combination of the two.

Park areas evaluated for significance through the National Register process are Bathhouse Row (a National Historic Landmark District since 1987) and the Indian Mountain novaculite quarry area (disapproved, 1995). As discussed at greater length in the archeology section, most experts continue to feel the latter resource is eligible; however, the "quarry/mining resources" cultural landscape category includes not only Indian Mountain but the total number of quarry areas in the park. The National Historic Landmark District of Bathhouse Row includes eight historic bathhouses, the administration building, the Bathhouse Row comfort stations, two fountains in front of the administration building, the Maurice spring pavilion, the Noble fountain at the Grand Promenade entrance on Reserve, the Grand Promenade, and the Formal Entrance. The Grand Promenade was designated a National Recreation Trail in 1982.

A Landscape Management Plan for Bathhouse Row was completed in 1989. It included treatment recommendations for Bathhouse Row and the Grand Promenade.

Status of Ethnographic Resources

Hot Springs National Park contains no ethnographic resources, as NPS guidelines currently define them. A few primary historical sources of poor documentary quality indicate that some Native American groups considered the hot springs to be of sacred medicinal value during the 1700s and 1800s. However, these groups were not well identified as to tribal affiliation; they could have represented any or all of several tribes that were native to the area historically or whose remnants passed through Arkansas during periods of tribal territorial disintegration in the face of American westward expansion. Descendants of most of these groups now reside in Oklahoma.

The park has not inquired about this matter among tribes whose presence was documented in Arkansas during the 1700s and 1800s. No members of any contemporary Native American group have approached the park about the hot springs. During NAGPRA negotiations in 1996, the two participant tribes (Caddo and Quapaw) did not mention any sacred sites within the park. The negotiations centered on objects collected outside of the park, most of which could be assigned no particular tribal "signature" by NPS-accepted experts. None of the items could be considered funerary objects by NAGPRA standards. During the early 1900s, after a zinc and lead mining boom in Oklahoma led to brief prosperity among several tribes, some Native Americans drove to Hot Springs to take the European-style baths in the same manner as other bathers.

Although many people of diverse ethnic backgrounds have come to Hot Springs for the baths and the spa atmosphere, and to live and work here, there is no evidence to suggest that any of these groups consider any park resources to be critical in defining their cultural identity. The park has conducted oral history interviews with many former bathhouse employees, some of African-American ancestry. The bathhouses were of great local economic significance for this group as a major source of employment since the late 1860s, but the resource cannot of course be considered critical in defining the African-American cultural identity in general.

The latter statement also holds true for the Caddo people, some of whose ancestors lived in this general area at the time of first historic contact. To date, no archeological evidence (historic or prehistoric) has been found to tie this culture specifically to the hot springs or any other area within park boundaries. A few archeological sites found in the park may be Fourche Maline (ca. 1000 B.C. to 800 A.D.), which some archaeologists believe developed in place into Caddoan culture.

The park's aboriginal novaculite quarries presumably had economic significance for tribally non-identifiable Native American groups. Archaeologists believe that aboriginal use of this resource peaked in the prehistoric Archaic Period. No members of any contemporary Native American tribe have approached the park about novaculite or any other natural resource in the park.

As part of an Ethnographic Needs Assessment, park personnel sent a document on this topic to Michelle Watson at the Midwest Archeological Center in mid 1995.

CULTURAL CONTEXT/THEMES

Significance:

The area now known as Hot Springs National Park was set aside in 1832 to preserve its numerous thermal and cold water springs. Given its designation in 1921 as a national park, it may well be the earliest expression of the concept of setting aside park areas for the benefit of society as a whole. Because of the background of U.S. Government involvement in its development and of numerous independent bathhouse operations characterizing its history, Hot Springs National

Park is a unique example of the American spa movement, a value that was recognized in 1987 when Bathhouse Row was designated a National Historic Landmark District. The unusual combination at Springs Reservation/National Park of therapeutic bathing regimens, related medical treatments, and relaxation in natural surroundings has resulted in a blending of landscaped spaces, architectural design, and natural areas that is unique to this national park.

Hot Springs National Park also contains a large portion of a system of prehistoric novaculite quarries that is among the most extensive in North America and that played a major role in Native American tool-making and the historic whetstone industry. As a cultural crossroads, the Hot Springs area enjoys a rich body of history and lore brought about by the importance of the African-American community in the bathing industry, the legacy of Spanish and French colonialism in the region, the lure of the area's geological resources for Native American and other ethnic groups, and the vicissitudes of daily life during and after the turbulent American Civil War period.

The summary of available written information on the cultural resources and the present investigation of this area of Arkansas indicates that while there are presently gaps in the record, there can be little doubt that the total sequence of prehistoric occupation will be found, if not in the park itself, at least in the immediate local area. The Paleo period (*circa* 12000 to 8000 B.C.) is not represented in this area's recorded sites or collections at the present time, but the characteristic fluted points have been found farther south in Arkansas along the Ouachita River, and on tributaries of the Red River in southwest Arkansas. Some late Paleo or very early Archaic novaculite projectile points have been found in the southwest part of the state. Thus, there can be little doubt that Native Americans knew of this lithic source soon after their arrival in the area and made immediate use of it for their tools. Evidence of this will undoubtedly be uncovered as more scientific investigations are completed.

Ample evidence exists of Native American occupation of the area during the Archaic period (8000 B.C. to 1000 B.C.). As hunters and gatherers, they undoubtedly found the mountains an abundant source of game and fish, as well as wild plants. Further exploitation of the novaculite is evidenced through stone tools of this time period being found farther and farther away from this source area. Southern Louisiana, and the famous Poverty Point site in northeast Louisiana are but two areas where Archaic tools of novaculite have been removed. Schambach's study at the Means and Cooper sites indicates a sizable permanent population in the area making maximum use of the environment (Schambach 1970). The sites found along Bull Bayou provide direct evidence of Native Americans in the park area during this time period (Baker 1975).

The early pottery-making and horticultural Woodland communities known locally as the Fourche Maline culture readily took to the ideas of agriculture and pottery-making introduced into the area. These "pre-Caddoan" cultures also made use of the novaculite lithic material for tools.

The few large, late prehistoric sites which have been excavated in the immediate area indicate that after about A.D. 1000 there were large Caddoan populations in the area, whose subsistence base was agriculture, who had a sophisticated social and religious system, and whose technology, particularly in pottery-making, was excellent. These large villages seem to be away from the hot springs themselves (unless one or more were destroyed in the central city development), but it is possible that hamlets and quarrying stations will be found to aid in interpretation of the way of life of the period.

According to local tradition, the first European to view the hot springs was Hernando de Soto, who explored the region of central Arkansas during 1541, but no documented evidence exists to substantiate that claim. A majority of scholars now argue against reconstructions of his route that include Hot Springs (Young and Hoffman 1993). In any case, in succeeding years the region was claimed at different times by both France and Spain until 1803, when France sold her land claims west of the Mississippi River in the transaction known as the Louisiana Purchase. The first Americans to formally explore the Arkansas hot springs region were William Dunbar and Dr. George Hunter. The fifteen-man party explored the Ouachita River and camped within the present boundaries of Hot Springs National Park in December, 1804. At the springs themselves they found "an Open Log Cabin and a few huts of split boards," all of which had been "calculated for summer encampment and which had been erected by persons resorting to the springs for the recovery of their health" (McDermott 1963). Two or three years after the Dunbar-Hunter Expedition, other Americans began to move into the area around the springs and build permanent residences.

The first permanent settlers to reach the hot springs area were quick to realize the springs' potential as a health resort; they built log structures to meet the basic needs of visitors to the springs. The first bathhouse was erected in 1830 and contained one wooden tub in which one could bathe three times for a dollar. A store was in place by the 1830s. The government, recognizing the springs' significant therapeutic value within the contemporary medical milieu, stepped in to protect them as a unique national resource, and four sections of land around the springs were set aside as a federal reservation by an Act of the Twenty-Second Congress of the United States approved by President Andrew Jackson on April 20, 1832. The act stipulated that "the Hot Springs and every other salt spring together with four sections of land including said springs, as near the centre thereof as may be, shall be reserved for the future disposal of the United States, and it shall not be liable to be entered, located, or appropriated for any other purpose whatever."

When the federal presence was not concomitantly established, settlers who were already in the area felt justified in their continued occupation of the land and establishment of bathhouses around the springs. Two years later when United States Geologist G.W. Featherstonhaugh visited the springs in 1834 he found a very primitive settlement which consisted of several "wretched looking log cabins, in one of which was a small store," but by 1856 Hot Springs could boast of a resident physician and seven bathhouses. These were either built directly over springs or

were equipped with thermal water tanks fed by wooden troughs. By mixing waters from springs of different temperatures or by cooling it in tanks, operators could regulate the heat of the bathing water.

As news of the reputed medicinal powers of the waters continued to spread, numerous health-seekers migrated to the spring area. By the mid 1800s, the springs were being claimed by several private citizens; in 1875, the government was forced to reconfirm its jurisdiction over the area in the Court of Claims. In 1877, after the court had ruled against the would-be private owners, the Hot Springs Commission was authorized to reestablish the boundaries of the reservation in a U.S. House of Representatives bill granting a right-of-way to the Hot Springs Railroad Company. In the same year a superintendent was appointed. The springs and surrounding mountains were again designated as Hot Springs Reservation, surveys were made, remaining claims were settled, and the balance of the original reservation was laid out into streets and lots for development.

After the hot springs and their environs were reestablished as government property, the area rapidly changed from a rough frontier town to an elegant spa city, with building, landscaping, and engineering projects proceeding apace. By 1878 Hot Springs had a permanent population of more than 3,500 and a bustling annual visitation of around 50,000. In 1884 the government enclosed Hot Springs creek in an underground masonry arch for flood and sewerage control, enabling bathhouses to be constructed along the former creek bed. The area was landscaped to create a pleasing, tree-lined park. Although now regulated by the superintendent of the reservation, privately owned bathhouses remained an integral feature of the spring area, and each new generation of buildings was larger and more luxurious than the previous one. In 1891 the indigent were also more comfortably accommodated by a brick government bathhouse providing free services to those who could not afford the private bathhouses.

In 1892 the government authorized funding for landscaping improvements to the reservation, and Secretary of the Interior John W. Noble placed Lt. Robert R. Stevens of the War Department in charge of the project. Lt. Stevens spent several years overseeing improvements to the reservation, including a grand entrance, fountains, mountain roads, a lake park on Whittington Avenue, and graded paths. Stevens's work was completed in 1898, just in time for the new influx of visitors brought in by Colonel Sam Fordyce's railroad line, finished in 1899.

When the National Park Service was created in 1916, administration of the reservation was transferred to the new organization. Hot Springs Reservation became Hot Springs National Park in 1921 by an Act of Congress "Making appropriations for sundry civil expenses of the government for the fiscal year ending June 30, 1922, and for other purposes," approved March 4, 1921. One of the "other purposes" included the stipulation that "Hot Springs Reservation shall be known as the Hot Springs National Park." This redesignation would have occurred soon after the establishment of the National Park Service, but at that time an Arkansas Congressman objected to the park's considerable revenues going into the federal

treasury.

By the first decade of the new century, the wooden Victorian bathhouses built in the 1880s were rapidly decaying from the moisture continuously permeating them; their wood frame construction also made them vulnerable to fire. The years between 1912 and 1922 saw another spate of construction as these outmoded buildings were replaced by fire-resistant brick and stucco bathhouses, some featuring marble walls, billiard rooms, gymnasiums, and stained glass windows. In 1922, a new government free bathhouse and genito-urinary clinic opened for business. In 1923 the last major change to Bathhouse Row occurred when fire destroyed the Arlington Hotel at its north end. The hotel was rebuilt on the other side of Fountain Street, and the vacant lot was never again to be a bathhouse site. By 1933 the original red-brick Army-Navy Hospital towering above the south end of Bathhouse Row had been replaced by the large yellow-brick complex that still occupies the site today as a rehabilitation facility.

The 1930s also brought other large construction projects. With the Public Works Administration in full swing, funds and manpower were allocated for several civil engineering projects at the park and on adjoining city land. Projects included new sewage disposal systems both in the city and at the park's Gulpha Gorge campground, reconstruction and paving of the West Mountain road system, trail work, and grading for a formal promenade behind the bathhouses. New buildings were also constructed: a park utilities complex, a park administration building, and a variety of buildings at the campground. The Civilian Conservation Corps also played a role in some of this work, particularly in road and trail construction.

By the late 1940s, breakthroughs in medical science and the decline of the railroads had led to a decrease in bathhouse business. Oddly enough, the decline of Bathhouse Row business actually created new bathhouse construction off park boundaries in the 1950s as the park sought applicants for use of the surplus thermal water. But this flurry of activity only precipitated a more rapid decline in the bathing industry, and the elegant Fordyce Bathhouse became the first casualty when it closed its doors in 1962. Other Bathhouse Row and hotel bathhouses followed suit during the next twenty years. Today Buckstaff Bathhouse is the only building on Bathhouse Row still operating as a bathhouse. The Fordyce Bathhouse has been renovated as the park visitor center and museum, and the other historic bathhouses, acquired by the National Park Service as they closed, are being offered for adaptive use leasing. Four hotels still operate bathhouses, and the former Government Free Bathhouse now operates as a thermal water health spa. The Leo N. Levi Hospital uses the thermal water in its hydrotherapy pool and treatment center.

The park boundaries have also undergone numerous changes since the original 2,529.1 acres were reserved in 1832. This acreage was greatly reduced in the 1877 resurvey of the reservation which resulted in the setting aside of only 264.93 acres immediately surrounding the springs. However, an 1880 Act of Congress increased the acreage to 900.63, taking in the surrounding North, West, Sugar Loaf, and East (Hot Springs) Mountains. Whittington Park area was added in 1896, bringing the

total area to 911.63 acres. In 1925, the 16 acres encompassing the Gulpha Gorge campground were donated to the park. A resurvey of the park's boundaries, the first since 1877, was made by the U.S. General Land Office in 1932. In 1935 the park accepted the donation of 63.2 acres of land on Indian Mountain by Colonel John R. Fordyce; the parcel included both prehistoric and historic novaculite quarries. The most dramatic change came in 1938, when Act of Congress H.R. 5763 extended the boundaries by 4,763 acres to connect the discontinuous mountainous areas, to include other parcels adjoining Fountain Street and Whittington Avenue, and to allow for two new entrances to West Mountain. Resulting land acquisitions continued through 1941.

In 1944, 32 acres used for the U. S. Public Health Service's transient camp were deeded to the park; upon closing of the camp, the land was transferred to the Hot Springs School District No. 6 and the Garland County Health Unit (should it ever be abandoned, its ownership will revert to the National Park Service). In 1959 5.3 acres of park land behind the Arlington Hotel were exchanged for a 4.75 acre inholding near the entrance that included Happy Hollow Spring on Fountain Street.

In the 1970s the park used available funds to secure various inholdings adjacent to trails, within the "recharge areas" for the thermal springs, or for other purposes: 1,314 acres were added at the end of 1972; 883 acres were acquired in 1973. Further land acquisitions in 1974-75, including a 240-acre tract donated by Weyerhaeuser Company, brought the park's size to 4,379.81 acres; acquisitions in 1977 increased it to 4,465.04 acres, and an additional 98.43 acres were acquired in 1979. Acquisitions continued through the 1980s and 1990's. The latest boundary change, authorized in 1993, has again reduced the park's boundaries (by 300 acres) but certain key inholdings are still being actively sought.

Themes:

The parks' cultural resources represent the following contexts and themes as listed in Revision of the National Park Service's Thematic Framework (1996):

I. PEOPLING PLACES: 1. HEALTH, NUTRITION AND DISEASE. The park's formal walks, trails, fountains, thermal water distribution systems, and bathhouses were all developed to provide a healthy regimen for invalids and non-invalids alike who came (and still come) to bathe and drink the thermal water. Therapeutic baths in the bathhouses were taken in conjunction with appropriate exercise and the consumption of plenty of thermal water.

II. CREATING SOCIAL INSTITUTIONS AND MOVEMENTS: 4. RECREATIONAL ACTIVITIES. Hot Springs National Park was a rapidly evolving expression of cultural attitudes towards health and fitness that culminated in the American Spa movement. The park's role in this movement was a unique one, because it represented the only spa that was owned by the government from its beginning. The Government Free Bathhouse, the administration building, and such landscaping features as fountains, drives, trails, pavilions, and formal walks and gardens directly resulted from this

government involvement.

III. EXPRESSING CULTURAL VALUES: 2. VISUAL ARTS. The bathhouses all incorporated contemporary visual arts movements and influences into their construction. The lobby and exterior of Lamar Bathhouse exhibit art deco touches. Maurice Bathhouse borrowed from the arts and crafts movement with its mission oak furnishings and Roycroft den. Bathhouse exteriors reflected the Classical, Spanish, and Mediterranean influences current during their construction: Superior Bathhouse and Lamar Bathhouse in eclectic commercial adaptations of the Classic Revival style, Hale Bathhouse in the Mission style, Quapaw and Ozark Bathhouses in the Spanish Colonial Revival style, Maurice Bathhouse in a mix of Renaissance Revival and Mediterranean styles, Fordyce Bathhouse in the Renaissance Revival style with both Spanish and Italian elements, and Buckstaff Bathhouse in the Neo-Classical Revival style. The lavish use of marble and terra cotta in walls, stairs, and statuary, and of art glass in skylights featuring mythical and woodland scenes contributed to the general opulence of some bathhouse interiors, particularly that of the Fordyce Bathhouse.

5. ARCHITECTURE, LANDSCAPE ARCHITECTURE, AND URBAN DESIGN. In 1892, Secretary of the Interior John Noble wrote to Lt. Robert Stevens and urged him to prepare a plan for improving the area with parks, formal walks, an observatory, and pavilions. In his reply, Stevens suggested that the services of Frederick Law Olmsted be retained for the project. Although this arrangement ultimately fell through, it was to be only the first of several ambitious architectural and landscaping projects envisaged for the park. Aesthetic enjoyment, hardly even a consideration in the early days of the hot springs, had gradually attained nearly equal footing with the therapeutic regimens offered at the bathhouses. Brochures written to promote various bathhouses in the early part of the century support this concept, with phrases like, "a monument to health and beauty," "The Maurice...the Bath House Beautiful," and "The Nation's Health and Pleasure Resort." The spa experience at Hot Springs now endeavored to soothe the spirit as well as to heal the body, and the architecture of the bathhouses, their interior decor, the Grand Promenade, and the landscape features all reflected their aesthetic milieu. Architectural objects in the collection, particularly the beautiful art glass and other elements removed from the Maurice Bathhouse, also embodied this new philosophy.

IV. SHAPING THE POLITICAL LANDSCAPE: 2. GOVERNMENTAL INSTITUTIONS. In 1877 Superintendent Benjamin Kelley, the first superintendent of Hot Springs Reservation, had the rough wooden bathing pavilions that provided free bathing to the indigent torn down. A riot ensued; Kelley, threatened with hanging, was forced to call in federal troops to calm the populace. Shortly thereafter, a wooden government free bathhouse was established on one of the sites. The strong subtheme of the people's right to life, liberty, and the pursuit of happiness set forth in the American Declaration of Independence runs throughout the history of Hot Springs National Park and is exemplified in the public bathhouse, fountains, drives, trails, and pavilions. Ever since the reservation was established, the thermal spring water has been available to men and women of all races, nationalities, and economic

backgrounds.

VI. EXPANDING SCIENCE AND TECHNOLOGY

2. *TECHNOLOGICAL APPLICATIONS.* The prehistoric and historic quarries that dot the mountainsides in Hot Springs National Park have left behind a record of the various technologies brought to bear on novaculite outcroppings through the centuries. Native Americans used the stone extensively in tool-making; European settlers found it to be an excellent whetstone useful in a variety of applications.

3. *SCIENTIFIC THOUGHT AND THEORY.* Objects such as vibrating massage instruments, vacuum electrode tubes, and douche equipment in the Hot Springs National Park collections can be used to trace the evolution of hydrotherapy and electrotherapy in medical practice. Archives provide documentary evidence of changing theories within these therapeutic philosophies.

4. *EFFECTS ON LIFESTYLE AND HEALTH.* Throughout most of the history of Hot Springs National Park, antibiotics, anti-inflammatories, and other pharmaceutical treatments were unavailable. In the 1800s and during the first half of the 1900s, a course of thermal water baths was the best treatment available for rheumatism, organ complaints, skin diseases, and other chronic ailments. Venereal diseases were treated in the bathhouses with a combination of hydrotherapy and mercury rubs. Countless sufferers came to the hot springs area to improve their health, and archival evidence shows that many of them left feeling better, sometimes dramatically so. Electric baths, vibrating massage equipment, and coupon books for mercury, hydrotherapy, and electromechanotherapy treatments are just a few of the tangible reminders of past therapies preserved in the bathhouses and the park collections.

VII. TRANSFORMING THE ENVIRONMENT.

1. *MANIPULATING THE ENVIRONMENT AND ITS RESOURCES.* From the simple troughs used to transport the thermal water in the 1800s to the complex underground collection and distribution system of today, systems have constantly improved, drawing nearer to the ultimate goal of delivering the resource of thermal water to the bather with its thermal qualities and purity intact. Plans, maps, and equipment in the park collection document these efforts; the collecting and pumping system in the administration building basement, the cooling station on Arlington Lawn, and the spring boxes on the side of Hot Springs Mountain exemplify their latest expression.

2. *ADVERSE CONSEQUENCES AND STRESSES ON THE ENVIRONMENT.*

3. *PROTECTING AND PRESERVING THE ENVIRONMENT.*

Park history dramatically demonstrates the inherent tension between the use of environmental resources and the need to preserve and protect them. This tension created environmental stresses that plagued the park in the 1800s. Careless blasting, intended to increase the flow of some springs, diminished the flow of other springs and made still others disappear forever. It also destroyed most of the natural calcium carbonate formations or "tufa domes" at the spring outlets; like cave formations, these domes formed over a period of centuries, and their loss was irreplaceable. Another environmental insult was the improper disposal of sewage (bathhouses and residences were built over the creek so that their water closets emptied directly into it) which essentially created a cesspool through the center of town, particularly a problem in the summer months. A third problem was inherent in

the situation of the springs on the hill; people and animals were free to foul the unprotected springs at their source. These problems were eventually all addressed by restrictions on blasting enacted in the 1880s, the completion of the Hot Springs creek arch in 1884, the covering of the springs by 1901, various sewerage projects beginning in 1924 and continuing through the present, and land purchases intended to protect the areas where rainwater enters the aquifer producing the thermal water. Documents such as reports, Congressional hearings, maps, and plans document both the problems and their solutions.

III. RESOURCE MANAGEMENT PROGRAM

OVERVIEW OF CURRENT PROGRAM AND NEEDS

This section presents brief discussions on each of the significant resource management challenges identified for the park. The park's nationally significant historic area contains many fine examples of both cultural and natural resources. The primary focus of the park's natural resource manager is the conservation of the historic values embodied in these resources. This mission requires close cooperation among park managers, resource management specialists, historians, interpreters, protection rangers, and maintenance personnel. Such cooperation is evident within this plan by the inclusion of several Integrated Project Statements.

Natural Resource Management

As is evident in the following tables and project statements, the level of funding and staffing have been inadequate to support the required efforts to implement many of the division's programs. As time and money become available, the park will proceed with developing action plans and data acquisition programs.

The lack of thorough knowledge of the park's natural resources and the inability to monitor their condition in relation to development activities, are the clearest threats to the values of the park and of highest priority in this management plan. The park will continue to seek funding to develop an inventory and monitoring program and to implement a comprehensive Geographic Information System to monitor park resources and the dynamic conditions occurring adjacent to its boundaries.

Other projects such as "Protect Air Quality Related Values" and "Wildlife Monitoring and Protection" both require that a more complete knowledge of the park's natural resources be acquired before appropriate management actions can be taken. Currently the park lacks a complete flora and fauna inventory and abundance record. The effects of air pollution on the park's natural resources and historic structures are unknown.

"Parkwide Vegetation Management" is also a strong concern. It affects the interpretation of natural as well as cultural resources of the park. Aerial photography has been obtained and will be utilized to document vegetative

conditions and trends. Other vegetation related issues are the management of exotic plants and exotic forest insects within the park. Native insects and native plants, especially in developed areas, can be management issues too. All require further resource study and monitoring.

The central issue concerning the park is establishing an inventory and monitoring program that will focus on the important natural resource projects the park has outlined, and provide a systematic way of storing, retrieving, and analyzing the data, such as the Geographic Information System (GIS).

Cultural Resources Management

As pointed out in the section on natural resources management, the level of funding and staffing are inadequate to support many of the division's federally mandated programs.

The issue of greatest cultural importance currently facing park management is halting the deterioration of the six non-operating historic bathhouses on Bathhouse Row. The Superior and Hale Bathhouses have had their exteriors rehabilitated and are stabilized for the present, but if they are not leased out soon, deterioration will probably begin anew. Quapaw Bathhouse has been recently provided with a new roof; its ornate tiled dome with copper cupola has been restored, and a park crew is removing the lead paint from its interior, all of which should improve the building's chances for ultimate leasing. The Lamar Bathhouse was the last of the bathhouses to close and is in fair condition. But with no environmental systems operating in the building, plaster is beginning to collapse, endangering the extensive trompe l'oeil murals in the lobby and the painted designs on the ceiling which represent the distinguishing interior architectural features of this bathhouse. Plans have long been on paper to use this building for park offices, but funding has not been available to date for writing specific proposals and plans for this project. In the meantime, the building continues to deteriorate. Maurice Bathhouse is in the poorest condition of all the bathhouses. Its old and persistently leaking roof has caused extensive damage throughout the structure: one step of a rusted iron and marble staircase recently collapsed; many of the building's interior wooden elements have rotted nearly away, and tile floors have buckled. The old roof has now been removed and a new roof installed, but without further stabilization, the bathhouse's once ornate interior will continue to degrade. This bathhouse is particularly important because it and the Fordyce Bathhouse flank the century-old formal entrance to the original Hot Springs Reservation. Its removal would destroy the symmetry at the center of Bathhouse Row and spoil the architectural balance which serves to unify the dissimilar bathhouses. The loss of Maurice Bathhouse would thus have a devastating impact on the historic and architectural character of the entire Historic Landmark District of Bathhouse Row. Stevens Balustrade, a limestone architectural feature at the original park entrance which now provides access to the Grand Promenade, also anchors Bathhouse Row. Its shell fountain no longer operates. The limestone is also crumbling in several areas and needs to be

replaced and stabilized.

The Fordyce Bathhouse is in the best condition of the seven non-operating bathhouses, but because it functions as the park visitor center, it requires a great deal of maintenance. Four of the other bathhouses--the Lamar, the Ozark, Quapaw, and the Maurice--are in poor condition. The building receives visitors who steal doorknobs, hardware, even antique thermostats off the walls. They have also taken exhibited objects from historically furnished rooms. The walls are very permeable, and moisture constantly loosens paint and plaster on walls and ceilings, wood trim and furnishings, and causes veneer to separate from the wooden panels of dressing and bath stalls. During past floods (which periodically occur on Central Avenue, the most recent occurring in 1990), waters entered the building's basement. This problem can recur in the future. The bathhouse's marquee has developed a leak which will be major construction to repair. The leak onto the tile porch floor constitutes a safety hazard; the leaks could eventually weaken the feature's structural integrity.

The former medical director's residence on Reserve Street is also in need of stabilization. One of the oldest buildings in the park, the stucco building boasts hardwood floors, pocket doors, numerous fireplaces, sleeping porches, and a formal entrance area. The building has been added to the park's leasing program, but in the meantime it is deteriorating. Water flows through the roof of the second floor sleeping porch into the front of the living room, which has destroyed the floor in that section of the room. Lead paint is flaking off the plaster walls, and mildew is rampant. The main roof is not leaking, but will need attention soon.

The extensive native stone walls along Hot Springs Mountain Drive have been a park feature since the 1890s. They have been repaired and reworked often in the past but are now in dire need of complete rebuilding. Some of the historic native stone shelters along the park's trail system need to be stabilized, and other very old native stone walls, culverts, and other features need to be evaluated for possible repair and rebuilding.

The Hot Springs Creek arch, a 113-year-old engineering structure under the sidewalk and front lawns of Bathhouse Row, is showing signs of aging and stress. The arch is the major means of controlling storm water along flood-prone Central Avenue as well as an historic engineering structure, and its stabilization is imperative. Federal funding formerly earmarked for determining the efficacy of a tunnel through West Mountain for flood control has been transferred to a project to renovate the creek arch. The collapse of the arch would destroy the Magnolia avenue, lawn, and sidewalk along Bathhouse Row and could radically destabilize the bathhouse foundations as well. Furthermore, it would shut down the hotel bathhouses, since the lines delivering thermal water to those buildings are anchored to the creek arch walls. The walls along Whittington Creek funnel water from West Mountain and Whittington Park into the creek arch. Projects to stabilize the creek banks began in 1905 when the lakes in the park were drained. A concrete ditch some 200 feet long was built there in 1928, and riprapping was

completed in 1943. The creek walls are now in critical need of stabilization. The thermal water distribution system has been reworked and is in good condition, but the collecting system needs to be evaluated.

In Gulpha Gorge Campground, the visitor contact station has water coming up through the floor during heavy rains. The caretaker's wood floor cabin, constructed in the 1930's (now used to house National Park Service volunteers) is in reasonably good condition, but it needs termite protection. Past termite damage is evident under the house, and termite activity will probably recur. The floor joists are rotting in some areas.

Projects addressing the servicewide issues of inadequate cultural resource documentation and monitoring programs, poor collection preservation maintenance, inadequate control of visitor impacts, and cataloging backlogs are all relevant to managing the cultural resources of Hot Springs National Park. However, since many of the cultural resources planning documents are outdated and need to be rewritten (most were filed before the reopening of Fordyce Bathhouse in 1989), it is sometimes difficult to adequately address these issues on the park level. Park collections are being brought into compliance with federally mandated standards, which demand more resources than are available.

List of Project Statements

Project statement numbers were reassigned for the update of this plan. Many statements were added or changed from the approved 1981 Plan. In addition, there is a list of newly created integrated cultural and natural resource management statements.

<u>Project#</u>	<u>Project Statement Title</u>
-----------------	--------------------------------

Memorandum

Date: August 27, 1997

To: Steve Cinnamon

From: Jill Medland

Subject: Draft RMP, HOSP

I have reviewed the subject RMP, which you gave me last week. The plan appears to meet the objectives and content requirements outlined in NPS-77, and is well organized and well written.

I would recommend that the park consider expanding the top 5-10 project statements to address as many of the NRPP/Water Resources/Geologic Resources ranking criteria as possible (if those criteria will continue to be used in the future). This will save time and effort in the future when project calls are made. The ranking criteria are attached.

NRPP GEOLOGIC + WATER RESOURCES RANKING CRITERIA ^{CA Attachment N1}

Responses to each criterion is limited to no more than 200 words per criterion. Responses that exceed this limit will be penalized.

1. **Significance of the Resource or Issue to the Park:** How important is the resource or issue to the park involved, relative to its other resources and issues? Weighting factor = 2X.

5 High significance: resource or issue is one of the most significant in the park, defined as unique, the subject of the enabling legislation, fundamental to this park's ecosystem and purposes (as opposed to, say, basic resources such as air and water that are fundamental to all parks), high priority in park RMP (this is not sufficient in itself), on federal or state lists as endangered or threatened, required by statute, etc. To earn a "5" will generally require several of these criteria to be met.

3 Moderate significance: resource or issue is important, but not singularly so for that park.

1 Resource or issue only peripherally related to park's purposes or uses.

2. **Severity of Resource Threat, Problem, or Need(s):** Weighting factor = 3X

5 Resource threat, problem, or need is current or imminent, and is extensive, persistent, immediate, complex, likely irreversible, a current or imminent risk to public health or safety, and/or hazardous. Delaying the project will result in, or continue, significant resource degradation.

3 Resource threat, problem, or need is potential, or moderate in extent, persistence, and/or complexity. Delay of the proposed project may result in, or continue, limited resource degradation. A potential public health or safety threat exists.

1 Resource threat, problem, or need is minor, infrequent, remote, and/or temporary. Immediate action is not necessary to protect resources. Delaying the project will not result in, or continue, significant resource degradation. Public health/safety is not an issue.

3. **Problem definition and information base:** How well is the problem defined? Weighting factor = 2X

5 The project statement clearly defines the problem. The information base regarding the problem is well described and provides sound foundation for problem resolution. If problem is lack of information, project statement clearly documents extent of existing information or lack thereof.

3 The project statement describes the problem in general terms. The information base is mentioned but only moderately well described.

1 Problem is poorly defined and/or availability of information is not addressed.

4 **Feasibility:** Weighting factor = 3X

5 Objectives are clear; methodologies, procedures, and proposed actions are technically sound; and time frame is reasonable to accomplish project objectives.

3 Objectives are fairly clear; or methodologies, procedures, and proposed actions are more or less technically sound; or project objectives may not be accomplished within time frame.

1 Objectives are not clearly stated; or methodologies, procedures, and proposed actions are not technically sound; or project cannot be accomplished within time frames.

5. **Problem resolution:** Will the proposed use of funds contribute directly to decisions or actions, which, when implemented, will meaningfully resolve a management issue? Weighting factor = 3X

5 The proposed project implements [for NBS...or develops information for implementing...] specific management prescriptions that will result in the final resolution of a natural resource issue or threat [for NBS... once the management phase is implemented...]; no additional actions other than follow-up

CN11)

monitoring are anticipated.

- 3 The proposed project will contribute to the future resolution of a natural resource issue or threat by clarifying management issues, articulating techniques or procedures, supporting an inter-agency or regional strategy, etc. Additional studies, management actions, and/or planning will be necessary to completely resolve the stated issue or threat.
- 1 The proposed project is not directly related to the development of management actions to resolve a specific issue or threat, but will contribute basic information about park natural resources. The focus here is on collection of baseline data, rather than implementation of a management action.

6. Transferability: How widely will the project protocols or results be useful? Weighting factor = 1X

- 5 The protocols or results of the project can contribute to tangible needs at the national level (NPS or other organization), and the park demonstrates the intention and ability to make the information available widely.
- 3 The protocols or results of the project can contribute to tangible needs at several parks or other organizations. The park demonstrates the intention and ability to make the information available to other units or organizations.
- 1 The project's tangible benefits are limited to the park.

7. Cost effectiveness: Given problem statement and proposed methodology, are cost estimates realistic and commensurate with the results to be produced? Weighting factor = 2X

- 5 Costs are realistic, well-researched, clearly spelled out, and defensible.
- 3 Costs appear reasonable given stated project objectives and procedures, but proposal does not provide supportive data to indicate how they were determined.
- 1 Costs appear disproportionately high or low in relation to the stated project objectives and procedures; proposal does not indicate that costs have been accurately evaluated.

8. Project Support: What resources (including in-kind contributions) are the park, region or other partner(s) willing to commit to this project. A detailed description of total project costs, including contributions is required. Weighting factor = 1X

- 5 70% or more of the project costs covered by park, region or partner(s)
- 4 51% - 69% of the project costs covered by park, region, or partner(s)
- 3 39% - 50% of project costs covered by park, region, or partner(s)
- 2 38% - 10% of project costs covered by park, region, or partner(s)
- 1 less than 10% of project costs covered by park, region, or partner(s)

UNITED STATES GOVERNMENT
memorandum

N15 (MWR-PL)

Date: July 7, 1997

To: Resource Management Specialist Steve Cinnamon

Through: Assistant Field Director, Planning, Legislation, and WASO
Coordination

From: Regional Review Coordinator Wene McManus

Subject: Resources Management Plan, Hot Springs National Park

The subject document was placed on review as requested and received the following comments:

Midwest Archeological Center

(Douglas Scott, Archeologist, Great Plains Team Leader)

We have reviewed the HOSP RMP draft. We are pleased to see the thoughtful discourse on the need for a park-wide archeological inventory. The funding estimates are reasonable, although we believe the field time allotted (four months) to complete a full inventory for 5500 acres is not adequate. We suggest the field time be doubled, unless there are plans not to inventory certain slopes or developed areas that would reduce the actual field time. We also suggest that the funding needs be identified and allocated over at least a two and possibly a three fiscal year timeframe to enable the project to be scheduled and completed in a reasonable sequence, archival research, field inventory and testing, and report preparation.

We appreciate the opportunity to comment on the draft.

No other comments were received. Should additional comments be received after this date, an updated memorandum will follow. Please contact me at extension 3082 if you have any questions.



United States Department of the Interior

NATIONAL PARK SERVICE

Hot Springs National Park
P.O. Box 1860
Hot Springs National Park, Arkansas 71902

IN REPLY REFER TO:

N16 (HOSP)
May 23, 1997

To: Regional Director, Midwest Region
Attn: Resource Management Specialist, Steve Cinnamon

From: Acting Superintendent, Hot Springs National Park

Subject: Resources Management Plan

Superintendent Roger Giddings has requested that I forward the enclosed copy of our draft park Resources Management Plan for you to initiate the appropriate review.

Roger has reviewed our initial draft and provided his comments, which have been incorporated into this copy. He feels this should be a high priority management document, and thus asked me to provide you an immediate copy for review and comment as soon as possible. While we are still inputting data to generate the software "funding and personnel" tables, we feel the textual meat of the plan is correct as stated, and request your assistance at this point.

Our resources management specialist Steve Rudd will cc:mail you an electronic version as soon as the revised text and data have been entered into the RMP software. In the meantime, if we can provide you any further information to expedite your review, please do not hesitate to let us know.

Rodney W. Harris

Rodney W. Harris

Enclosure

Project Statement
Last Update: 05/01/96
Initial Proposal: 1994

HOSP-C-001.001
Priority: 10

Title : BUCKSTAFF BATHHOUSE ON BATHHOUSE ROW
Sub-title: HSR/OTHER REPORTS, NHL

Funding Status: Funded: 0.00 Unfunded: 100.00

Servicewide Issues : C57 (SPEC STUDY)
C52 (HSR)

Cultural Resource Type: STRC (Structure)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

This is the only structure on Bathhouse Row, a National Historic Landmark district, that is still privately operated as a traditional bathhouse. The building and its historic furnishings have only been documented in cursory fashion. The Board and Manager are sensitive to historical values but would likely be more so if they better understood the site, the building itself, its furnishings, and the Buckstaff's overall significance. The Buckstaff, an imposing edifice in the Neo-Classical Revival style of architecture, was compared by one superintendent to the Irish Parliament building. It has operated continuously since its construction in 1912. In the future, the park would benefit by acquiring and curating certain objects in the Buckstaff representative of the spa's heyday. The park has inadequate storage for them (the park already has over a half million artifacts in its museum collection, some not yet adequately catalogued and housed). Representative bathhouse equipment/furniture examples in good condition remain at the Buckstaff. These items need to be identified in the event they might be considered for disposal by bathhouse management and funds are available, however. The Nauheim Bath, for instance, the only one known to have existed in Hot Springs, needs to be documented as to its former location and use. A final hazard to the safety of this venerable building is the fact that it is located, like all the bathhouses, in a flood zone.

Description of Recommended Project or Activity

The Historic Structure Report should be done by the National Park Service. An Historic Furnishings Report would be useful, since many historic items exist at the Buckstaff. Their locations and uses should be documented in case the concessioner decides to dispose of them. The groundwork would already be in place then, in the event that the NPS must acquire these objects. No Preservation Maintenance Plan exists for this historic structure. This would be valuable in the event that the Buckstaff goes out of business. It would also guide maintenance efforts while the building remains an operating bathhouse.

BUDGET AND FTEs:

-----FUNDED-----				
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	=====
Total:			0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	RES	One-time	100.00	1.00
Total:			=====	=====
			100.00	1.00

(Optional) Alternative Actions/Solutions and Impacts

The Buckstaff can continue to operate under maintenance agreements which include the building's historical merits, but a Preservation Plan would be preferable. The bathhouse could prepare the plan. Regardless of who does the work, studies need to be completed: the GMP states that the Buckstaff or another bathhouse will continue to function as a bathhouse on Bathhouse Row. For all practical purposes the Buckstaff can best continue to fill this role; the Fordyce is now the park Visitor Center, and the vacant bathhouses are far from being in operating condition. If something happens to threaten Buckstaff business, steps will need to be taken to insure continued operation. The GMP mentions that the business should be subsidized if necessary; however, if reasonable support is provided to the concession, and economic progress continues with other bathhouses and the adjacent city, this potentially awkward arrangement can be avoided. If the Buckstaff should go out of business and the park is unprepared to take over its operation, the building could remain unused for an indefinite period of time, suffering damage to its fabric as with the presently vacant

bathhouses. The park would enjoy acquiring numerous representative furnishings in this scenario if funding is available. As the concession survives, it may also decide not to keep representative furnishings. If the park could acquire some or all, it would need to process them, and arrange for storage, placing further strain on the park. This recently happened with Buckstaff archives, some 23 linear feet, which had been stored in the concession's periodically flooded basement. The park accepted donation of this valuable resource. These items must now be cleaned, sorted, catalogued, and microfiched, and a Finding Aid for researchers must be prepared. This is stated on Page 12 of the Park's Scope of Collections.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)
HSR (unknown or missing code)

Explanation: 516 DM6 APP. 7.4 B(2)

Project Statement
Last Update: 03/15/95
Initial Proposal: 1994

HOSP-C-002.001
Priority: 2

Title : FORDYCE BATHHOUSE VISITOR CENTER - BATHHOUSE ROW
Sub-title: REHAB: SAFETY/SPEC POPS

Funding Status: Funded: 0.00 Unfunded: 160.00

Servicewide Issues : C56 (REHAB, ETC.)

Cultural Resource Type: STRC (Structure)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

The adaptive restoration of the Fordyce Bathhouse has received much attention, but a few problems remain with regard to flood-proofing, accessibility, and climate control. Numerous pipe stubs and open pipes are allowing sewer gases and water vapor into the basement. Others allow water vapor from the basement onto other floors. The plexiglass panels on the porch roof marquee are too flexible to be sealed. They have been repaired and sealed numerous times but continue to leak. A new set of waterproof panels is necessary. The leaks on the porch create wet places on the tile porch. The front door is not handicapped-accessible. The HVAC system does not always function adequately, especially in reference to humidity. On a few occasions it has appeared to be raining within the building (in exhibit areas) as the result of the system generating unwanted humidity.

Description of Recommended Project or Activity

All dismantled and cut-off pipes need to be securely closed. All unused vents and openings need to be sealed. A replacement for the plexiglass panels in the porch roof must be found and implemented. The front door must be made accessible in some fashion, without compromising historic integrity or appearance. The HVAC system should be adjusted or upgraded to meet the challenge of maintaining appropriate humidity levels.

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
		Total:	0.00	0.00
		-----UNFUNDED-----		
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	MIT	One-time	80.00	2.00
	MIT	One-time	80.00	2.00
		Subtotal:	160.00	4.00
		Total:	160.00	4.00

(Optional) Alternative Actions/Solutions and Impacts

Considerable progress has been made by various park staff, independent of any special funds, in correcting earlier problems at the Fordyce. If sufficient funding is given, this local approach could work again.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 C(18)

Project Statement
Last Update: 03/15/95
Initial Proposal: 1994

HOSP-C-003.001
Priority: 5

Title : CURATION AND CATALOGING OF MUSEUM COLLECTIONS
Sub-title: RESOURCE PROTECTION

Funding Status: Funded: 0.00 Unfunded: 225.00

Servicewide Issues : C81 (COLLECTIONS)
C47 (STORAGE)

Cultural Resource Type: COMB (Combination)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

Curatorial duties at Hot Springs National Park require expertise in a variety of disciplines because of the diverse nature of its collections. In addition, extensive housekeeping and monitoring duties are required for large exhibit and collections storage areas. Storage areas must be reorganized to address curatorial deficiencies reported in the Collections Management Plan, the Collections Storage Plan, and the Guidelines for Furnishings Maintenance and Protection. Finally, as substandard storage buildings for objects are discontinued, new areas must be found and readied for use, and objects must be prepared for storage in accordance with N.P.S. guidelines. Hot Springs National Park has approximately 247,300 catalogued objects in its collection (comprising nearly 8,000 individual catalog records), including some 125 linear feet of archives. A computer hardware failure resulted in the loss of the park's Automated National Catalog System (ANCS) database in 1992; since that time, all of the catalog records have been reinput, and all new records are routinely entered into the database. Approximately 256,400 accessioned objects remain uncatalogued. The latter may be grouped as follows:

- a) Approximately 2,000 photographic images. These have been roughly sorted but are not yet catalogued.
- b) Approximately 500 oversized maps, blueprints, technical drawings, and architectural drawings. These need to be processed, catalogued, and microfilmed.
- c) Approximately 90 linear feet of archives, comprised of the remainder of collection formerly in storage at the University of Arkansas and of recently accessioned archives from the Buckstaff Bathhouse. The former have now been accessioned, roughly sorted, and placed into acid-free boxes, but not otherwise processed, catalogued, or microfiched. The latter have just come into the collection and are in poor condition, requiring cleaning, sorting, rehousing in archival storage containers, cataloguing, and

microfiching. With an increasing demand for research into archival records by contractors, park personnel, and private citizens, research duties for the curatorial staff are expanding rapidly. Microfiche and microfilm, accompanied by good finding aids, will somewhat alleviate the situation, but it will take a great deal of time to put these into place. Less than half of the catalogued archives have been microfiched. Finding aids are on file for approximately 20% of the administrative archives (a collection of some 70 linear feet) and for 1100 images in the photographic collection, but finding aids need to be completed for the remaining archival and documentary collections. Particularly the collection of maps, technical/architectural drawings, and blueprints. As photographs are catalogued, they need to be added to the existing finding aid. d) A collection of 74 stained glass panels taken from the Maurice Bathhouse. When removed from the bathhouse, the panels were carefully packed, but they were not cleaned, and many of them were heavily contaminated with pigeon droppings. They are now stored in large plywood boxes, nailed shut, making it impossible to monitor their condition or to allow researchers to view them. And they are stored in the basement of the MDR, where they are subject to water. According to conservators at Harpers Ferry Center, the pigeon residue is highly acidic and, when dampened with water, could easily etch the stained glass. Two deteriorated boxes were unpacked this autumn. The panels were vacuumed and wiped with a soft dry cloth but not otherwise cleaned before being placed in museum map cases; they will eventually need to be more thoroughly cleaned with ammonia and alcohol. The rest all need to be unpacked, cleaned, catalogued, and placed on covered, padded shelving in controlled storage. In other areas of curatorial documentation, work also needs to be done. The more recent accession records are current, but many early entries are confusing and inadequate. The current museum technician has been able to resolve some of the problems through record searches and interviews with employees and others. As a result, numerous apparently missing items have been located and placed back into the collection. Other collection items are in the process of being deaccessioned; the histories of these have been traced as carefully as possible and the cause (or probable cause) of their loss determined. Missing paperwork has been filed correctly whenever problems were resolved. However, this process needs to be applied a hundredfold to the rest of the older records; accession reports, object lists, donor forms, and purchasing data were not consistently filed in the past. Catalog records also have a great many errors that need to be corrected. In the past, much cataloguing and inputting of catalog records into the computer has been done by volunteers. In retrospect, this was not a good idea. NPS regulations on access to collections are strict and clear; only park personnel directly responsible for collections are to have unsupervised access to them. Unless volunteers are given careful background checks, they should not have access to collection objects or to permanent collection records, and certainly not to both at the same time. The potential for doctoring records to cover theft is there, if remote, and this has occasionally occurred at other museums. Those considerations aside, the practice of

using volunteers for cataloging at this park has created more work than it has accomplished. The present museum technician has spent many, many hours undoing the cataloging errors of well-intentioned volunteers; in most cases, cataloging items is less time-consuming than recataloging them. Other curatorial paperwork includes an annual inventory of museum property, an annual collections management report, annual amendments and additions to the catalog records kept in the Washington office, annual reports on backlog cataloging and CRM projects, and intermittent requests for other reports of various kinds. The Scope of Collections Statement (rewritten completely in 1993) must be periodically updated, as must the curatorial portion of the Cultural Resources Management Plan; other mandated plans (Collections Management Plan, Collection Storage Plan, etc.) must be reviewed and updated as necessary. In addition to curatorial paperwork, the curatorial staff is responsible for the housekeeping maintenance of over 4,200 square feet of exhibit/curatorial storage space, over 1,000 exhibited objects, and 12 exhibit cases. The curatorial staff is also required to carry out an I.P.M. program for all exhibit spaces and collection storage areas and also to maintain constant environmental monitoring of these areas, with computerized records of the results kept up to date. Curatorial supplies must also be monitored and kept in stock.

Description of Recommended Project or Activity

1. 1. HIRE AN NTE-A-YEAR MUSEUM TECHNICIAN TO COMPLETE THE PROCESSING OF THE ARCHIVES. With help from a seasonal interpretive ranger, the current museum technical has processed and catalogued around half of the archival collection. Less than half of this collection has been microfiched; less than 10% is covered by finding aids. The park has no administrative history, and the archival material in the collection would be invaluable to anyone assigned to such a project. With overall research demand for this material already on the increase, it is essential that it be made more accessible to researchers through microfiche or microfilm and well-indexed finding aids. A well-qualified full-time GS-05 museum technician could probably complete this task in a year to 18 months, if he or she had no other duties. 2. HIRE A PART-TIME MUSEUM TECHNICIAN TO COMPLETE THE CATALOGING OF THE INSECT COLLECTION. An insect collection of approximately 1800 specimens needs the attention of an entomologist of at least of someone with a strong background in zoology. Some of the specimens need to be stabilized by being remounted correctly; the rest need to have nomenclature checked and updated if possible before they are catalogued. The scope of this work is not within the expertise of the current museum technician, nor does she have the necessary time to spend on the project. Hiring a part-time temporary GS-04 or GS-05 museum technician for a year would eliminate this cataloging backlog. Possibly a senior level zoology student at a nearby college could be hired part-time for this purpose. 3. HIRE AN NTE

1-YEAR GS-04 MUSEUM TECHNICIAN TO ASSIST WITH HOUSEKEEPING, MONITORING, AND OTHER ROUTINE DUTIES. In addition to the above NTE positions, a GS-04 museum technician should be hired for 1 year to assist the curator with the many curatorial duties that require more than one person to complete and to free the curator from routine duties. This would allow the curator to finish reorganizing storage and to complete the cultural cataloguing backlog (consisting mostly of photographs, oversized documents, and other archival materials) not addressed by specialized personnel. Once all the backlogs of work are complete, all NTE positions can be allowed to lapse.5. HIRE A PERMANENT PART-TIME MUSEUM TECHNICIAN TO ASSIST THE CURATOR AND TO MONITOR THE BUILDING. Although the curator should be able to handle most of the work load after the collection is reorganized and its records updated, there are always curatorial tasks that take more than one person to accomplish. After the above NTE positions have lapsed, a permanent GS-04 museum technician should be hired for 20 hours a week to assist with such duties as changing exhibits, cleaning exhibit and storage areas, completing annual inventories, etc. In addition, an extra pair of eyes and feet would be welcome in monitoring the building, particularly during times when tampering and theft occur with more frequency.

BUDGET AND FTEs:

-----FUNDED-----				
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	=====
Total:			0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	RES	One-time	90.00	3.50
	MIT	Recurring	45.00	1.50
Subtotal:			135.00	5.00
Year 3:	MIT	Recurring	45.00	1.50
Year 4:	MIT	Recurring	45.00	1.50
Total:			225.00	8.00

(Optional) Alternative Actions/Solutions and Impacts

1. HIRE AN INTERPRETIVE RANGER WITH COLLATERAL DUTY AS CURATOR AND CONTINUE THE NTE MUSEUM TECHNICIAN POSITION. In the past, curatorial duties at Hot Springs National Park have always been performed as the collateral duty of an interpretive ranger. When the last ranger/curator quit, all of his duties and responsibilities were shifted to a GS-05 temporary museum technician who has the responsibility but not the authority to make decisions concerning collections and who has too uncertain an employment future to be included in long-term planning. Curatorial concerns therefore cannot always be adequately voiced in management decisions. To reassign the curatorial collateral duty to one of the four interpretive rangers now employed is impracticable; they simply cannot be stretched any further to perform this duty. A fifth interpretive ranger could be hired to take on this collateral duty, with sufficient time scheduled to perform it. This ranger could then supervise the museum technician in accomplishing the tasks for which the position officially rated: housekeeping, monitoring, other specialized curatorial duties. As a GS-09 permanent employee, he or she would hopefully be able to confer with management about long-term decisions affecting the collections. 2. MAKE THE MUSEUM TECHNICIAN POSITION PERMANENT AND DEDICATE ONE SEASONAL INTERPRETER POSITION PER SEASON TO CURATORIAL DUTIES. This option would only be workable if the pool of seasonals each summer were large enough to completely free one seasonal ranger for these duties and if it contained an individual with writing skills, curatorial skills, or a background in zoology who could be utilized in this way. However, other inevitable demands on a seasonal interpreter's time make it difficult for him or her to concentrate solely on curatorial duties. The problem of curatorial responsibility without the necessary authority to carry it out would not be addressed by this solution. 3. CONTINUE WITH THE STATUS QUO REGARDING MUSEUM PERSONNEL. If this option is chosen, eventually no one will be responsible for curation, since the current museum technician is not a permanent employee. If a qualified replacement cannot be found, many of the same problems (lost objects, poor records, improper storage, failure to carry out IPM and environmental monitoring, poor housekeeping with resulting damage to artifacts, poor access to archival and other research materials, inaccurate regional reports) that the current museum technician has been working so hard to correct will reinstate themselves. Perhaps more importantly, museum collections will continue to be given less attention and respect than they, as a valuable park resource, deserve.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 E(2)

Project Statement
Last Update: 03/15/95
Initial Proposal: 1994

HOSP-C-004.001
Priority: u

Title : HISTORIC STRUCTURES REPORT
Sub-title: MISC SPA BUILDINGS

Funding Status: Funded: 0.00 Unfunded: 70.00

Servicewide Issues : C52 (HSR)

Cultural Resource Type: STRC (Structure)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

No Historic Structure Report exists for the following park buildings: Reserve Avenue Duplexes and Garages; Gulpha Gorge Ranger Residence; Trail Shelters; Pagoda Shelter; Utility (Maintenance Complex) Buildings. All of these buildings would be eligible for the National Register under a Multiple Property Nomination. The most recent of them, the duplexes and maintenance buildings, date from the 1930s. All the buildings are in use but have not been assessed for stabilization and preservation needs. The duplexes are currently occupied by NPS and Forest Service employees, the ranger residence is occupied by park volunteers, and the other buildings retain more or less their original function. Items that may seem small, such as peeling paint, may be symptomatic of greater problems such as structural movements. Active direction concerning the stabilization and maintenance of the structures is mandatory for their preservation.

Description of Recommended Project or Activity

The needed Historic Structure Report would include an administrative data section, physical history and analysis section, an appendix for each building or group of buildings, and an annotated bibliography. The document would: recommend and justify any proposed treatments; include a statement of significance on the structures and their settings as well as descriptions of the buildings and their sites over time; record existing conditions; recommend steps for building and landscape preservation, rehabilitation, and accessibility; analyze impacts according to 36 CFR 800.

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
Total:			0.00	0.00
		-----UNFUNDED-----		
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 1:	RES	One-time	35.00	1.00
	RES	One-time	35.00	1.00
Subtotal:			70.00	2.00
Total:			70.00	2.00

(Optional) Alternative Actions/Solutions and Impacts

The completion of this Historic Structure Report would establish guidelines for allowable and disallowed changes and modifications and would govern activities that affect the qualities and characteristics that make the property eligible for inclusion in the National Register. If this study is not completed, the park will have no adequate way of weighing the impact caused by gradual accretion. A series of changes, no matter how slight, may eventually affect the qualities and characteristics that made the properties eligible for inclusion in the National Register. Damage is already evident, especially on the trail shelters and Pagoda shelter: roof tiles, woodwork, drainage channels, and stonework may need to be replaced or extensively repaired. If the way is not paved for this, further deterioration will occur.

Compliance codes : HSR (unknown or missing code)

Explanation:

Project Statement
Last Update: 03/15/95
Initial Proposal: 1995

HOSP-C-005.001
Priority: 4

Title : STEVENS BALUSTRADE-FORMAL ENTRANCE-GRAND PROMENADE
REHABILITATION

Sub-title: HISTORIC VIEWSCAPE RESTOR

Funding Status: Funded: 0.00 Unfunded: 618.00

Servicewide Issues : C54 (EMERG STABL)
C56 (REHAB, ETC.)

Cultural Resource Type: STRC (Structure)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

Two architectural features from the 1890s, formerly part of a three-tiered arrangement in the middle of Bathhouse Row, still remain, but--being composed primarily of limestone--they have suffered a great deal of deterioration. Some emergency work was done on the Stevens Balustrade in 1986, but without further and more extensive renovations this prominent structure will continue to crumble. Its arched alcove, the center of attention, is in poor condition and attracts adverse comment because the distinctive scallop-shaped fountain is dry. In many places the mortar is eroding. Groundwater runs across the sidewalk beneath the balustrade; this is believed to come from the Stevens Spring. The spring and balustrade are named after Captain Robert Stevens, who designed the balustrade, the Formal Entrance Pylons, and many other landscape features in the Bathhouse Row area. The Formal Entrance Pylons are in fairly good condition considering they were once sandblasted, one wing was propped up, and the bronze eagles were painted. The paint is weathering, but unsightly flecks and patches stubbornly adhere to these creations of turn-of-the-century artist Edward Kemeys.

Description of Recommended Project or Activity

The hot water flow in the "shell fountain" should be restored; water displays and fountains have been features of the park for a very long time, and this fountain is located in a high-use area next to the Visitor Center. If necessary the water could come from a distribution line, rather than a collection line as it did

before. The water from the intermittent Stevens Spring should be directed to a subterranean drain so that it isn't a problem for the Stevens Balustrade, a safety hazard on the sidewalk, and a source of seepage into the Fordyce Bathhouse Visitor Center. Most of the stonework needs to be repointed. Laminated stones, several spalled stones, and chipped stones need to be replaced as well as many of those in the alcove that are severely deteriorated. The alcove stonework will all need to be removed and replaced with custom-made stonework. The pipe in the fountain will need to be replaced. Drains and pipes need to be in a culvert so they can be cleaned and repaired without tearing up concrete. The concrete slab may have to be replaced. The bronze eagles need to be blasted with walnut shells (or some other non-damaging dip strip agent) to remove the paint and allowed to weather to a green patina or be coated. These rehabilitation efforts would return the Stevens Balustrade and Formal Entrance Pylons to their historic condition as outstanding architectural components of the park's Formal Carriage Entrance.

BUDGET AND FTEs:

-----FUNDED-----				
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	=====
Total:			0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 1:	MIT	One-time	250.00	6.00
Total:			=====	=====
			250.00	6.00

(Optional) Alternative Actions/Solutions and Impacts

Delaying this project may only result in unfavorable visitor reaction for a few years; but ultimately the impact will be more severe, as repair costs go up, water seepage undermines the Visitor Center foundations, and the Stevens Balustrade is lost--a very real possibility, remembering the demolition and removal of the Bandstand which was at one time the crown of the three-tiered architectural arrangement referred to previously. Such a loss would certainly tarnish the National Historic Landmark status of Bathhouse Row.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 F(6)

Project Statement
 Last Update: 03/15/95 HOSP-C-006.001
 Initial Proposal: 1995 Priority: 9

Title : LIBBEY MEMORIAL PHYSICAL MEDICINE CENTER/HEALTH SPA
 Sub-title: HSR

Funding Status: Funded: 0.00 Unfunded: 280.00

Servicewide Issues : C52 (HSR)
 C56 (REHAB, ETC.)

Cultural Resource Type: STRC (Structure)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

The Libbey was built in 1922 as the most recent Government Free Bathhouse, for indigents, and as a center for research on many of the diseases that these people suffered from. Important Public Health Service investigations were conducted here on matters such as syphilis, a great concern to bathers. The building's primary use has evolved since the 1950s to include treatment of arthritis and other ailments, as well as serving as a health spa concession open to the general public. The Physical Medicine Center located here is named after a former Superintendent of the park. First and foremost, a Historic Structure Report should be done on this historic, National Register eligible building. Although the building's changing businesses have required certain alterations over the years, much of the original architecture remains intact.

Description of Recommended Project or Activity

A qualified architectural historian, either an NPS employee or a university-based professional, should be hired to do a Historic Structure Report on the Libbey.

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	=====
Total:			0.00	0.00

-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	RES	One-time	40.00	1.00
	MIT	One-time	240.00	5.00
		Subtotal:	280.00	6.00
		Total:	280.00	6.00

(Optional) Alternative Actions/Solutions and Impacts

Compliance with federal law, especially one of such high profile to special populations, is mandatory. Before ADA-related adaptations occur within this historic building, a Historic Structure Report is appropriate.

Compliance codes : HSR (unknown or missing code)
EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 C(18)

Project Statement
Last Update: 03/15/95
Initial Proposal: 1995

HOSP-C-007.001
Priority: 8

Title : ARCHEOLOGICAL SURVEY OF HOT SPRINGS NATIONAL PARK
Sub-title: EO 11593/NHPA COMPLIANCE

Funding Status: Funded: 0.00 Unfunded: 460.00

Servicewide Issues : C01 (OVERVIEW)
C02 (ID & EVAL)

Cultural Resource Type: CULL (Cultural Landscape)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

A complete archeological inventory of the park is required to comply fully with Executive Order 11593 and the amended Section 106 of the National Historic Preservation Act. Such a survey would be for the purpose of identifying and evaluating all National Register-eligible archeological sites, both prehistoric and historic, in the park. A preliminary reconnaissance in the 1970s by Charles Baker of the Arkansas Archeological Survey revealed several such sites, now registered with the state but not fully evaluated. Miscellaneous ad hoc surveys done in the park since then, in advance of development in various areas, have revealed still more sites, which are now registered but not fully evaluated. Several other sites in the park lack even basic documentation to confirm or refute stories attached to them by "local historians." Still other sites are very likely buried beneath deep alluvial soil, or remain undiscovered or unappreciated for other reasons, in this park of approximately 5,500 acres.

Description of Recommended Project or Activity

A complete archeological survey should be done by a professional organization competent to deal with a project of this magnitude. This could be accomplished by full-time archeologists employed by the NPS, or the job could be contracted to an archeology firm (either state-based or private). An idea of what is needed can be had from the following excerpts from a letter to the park, dated December 20, 1994, by the Arkansas Archeological Survey: "A cultural resources survey of Hot Springs National Park should be undertaken in at least two phases. The first of these consists of a

background review (including a search of the AMASDA database) and, importantly, intensive documentary and archival research focusing on historical changes in the landscape of the Hot Springs area. The latter should focus on the location, identification, and evaluation of published and unpublished sources, and will entail research trips to various archival/photographic repositories, including the National Archives and the archives maintained by the National Park Service. We estimate that a budget of approximately \$80,000 over a period of 4 months should be sufficient to complete this phase. The second phase consists of archaeological/architectural field and laboratory investigations, and would minimally require the services of one Project Archaeologist, 2 Project Assistants, and 6 Archaeological Technicians. With this personnel structure, we estimate that approximately 4 months would be required to complete fieldwork, with an additional 4 months of laboratory analysis and report preparation. The level of investigation envisioned here would be sufficient only to identify and record cultural resources, not to make accurate site boundary determinations. This point is critical because of the extensive novaculite quarries present within the park; boundary assessments of these resources would require substantially more funds than included in our budget estimates. We estimate that a budget of approximately \$332,000 over a period of 8 months would be sufficient to complete this phase." It would also be advisable to consult with one or more Native American tribal entities, as appropriate. Although no historic-period Indian group can be documented as having definitely lived in, visited, or used what is now park land, a prehistoric culture known to archeologists as Fourche Maline was present here. Archeologists believe the Fourche Maline developed in-place into various Caddoan tribes. Later but still prehistoric Caddoan sites exist in the Hot Springs area; however, none are confirmed at this time for the park itself. The pre-1800s historic tribe closest to Hot Springs was the Cahinnio, remnants of which merged with other Caddo tribes during the 1700s. The land that ultimately became Hot Springs National Park was acquired by the United States through a treaty with the Quapaw, although no Quapaw sites have been found here. Other groups, e.g. the Choctaw, crossed this region on their way to Oklahoma during the most intensive phase of Indian Removal in the early to mid-1800s. Although some local residents claim Indian heritage, no tribe is currently incorporated in Arkansas (but it should be noted that one band of Cherokee will be relocating to the Fort Smith area).

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	=====
Total:			0.00	0.00

-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	RES	One-time	460.00	1.00
		Total:	=====	
			460.00	1.00

(Optional) Alternative Actions/Solutions and Impacts

The present state of affairs does not enhance the park's reputation with the public or with cultural historians, and it does nothing to discourage a possible outbreak of pothunting (if indeed that has not already occurred).

Compliance codes : NHPA ((106) NAT. HIST. PRES.)
OTHER ()

Explanation: Executive Order 11593

Project Statement
Last Update: 03/15/95
Initial Proposal: 1995

HOSP-C-008.001
Priority: 1

Title : BATHHOUSE ROW REHABILITATION
Sub-title: PRESERVATION OF NHL

Funding Status: Funded: 0.00 Unfunded: 1,700.00

Servicewide Issues : C15 (REHAB ETC.)
C61 (LEASING)

Cultural Resource Type: STRC (Structure)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

Bathhouse Row, a National Historic Landmark in the park's busiest area, needs to be restored to its former splendor. For the past several years, in accordance with the park General Management Plan, five of the eight bathhouses have been offered as part of an Historic Leasing Program. These vacant bathhouses are the Superior, Hale, Maurice, Quapaw, and Ozark (the Fordyce is the park Visitor Center, the Buckstaff still functions as a concession bathhouse, and the Lamar will be retained for park use). Asbestos has been removed from all the buildings, but lead-based paint remains a problem. The bathhouses are in varying states of deterioration, as they have no climate controls and no utilities at present.

Description of Recommended Project or Activity

Substantial work is required before the buildings will be attractive to business. Lead-based paint must be removed. This has been completed for the Superior and Hale. The park must repair infrastructure, improve drainage, and restore surrounding grounds to support rehabilitation of the vacant bathhouses for adaptive use by private lessees. The park must rehabilitate the designed landscape of the area, including plant materials, thermal features, walks, and architectural elements. These facilities must be modified to accommodate mobility impaired visitors and staff. Much of this work may be contracted out. The NPS must provide technical assistance and coordination of planning, design, and construction activities associated with rehabilitation of the leased bathhouses and with community revitalization efforts.

BUDGET AND FTEs:

-----FUNDED-----					
Source	Activity	Fund Type	Budget (\$1000s)	FTEs	
			=====		
Total:			0.00	0.00	
-----UNFUNDED-----					
	Activity	Fund Type	Budget (\$1000s)	FTEs	
Year 1:	MIT	One-time	1,700.00	4.00	
			=====		
Total:			1,700.00	4.00	

(Optional) Alternative Actions/Solutions and Impacts

Failure to complete the work could result in: public exposure to known health hazards (lead and increasingly unstable buildings), deterioration of the structures and landscape features of a historic district of national significance (or subsequent increased stabilization costs), and failure to meet NPS commitments to support rehabilitation of leased bathhouses and community downtown revitalization efforts.

Compliance codes : NHPA ((106) NAT. HIST. PRES.)
EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 C(18)

Project Statement
Last Update: 03/15/95
Initial Proposal: 1995

HOSP-C-09.001
Priority: 6

Title : STORAGE & ENVIRONMENT OF COLLECTIONS
Sub-title: RESOURCE PROTECTION

Funding Status: Funded: 0.00 Unfunded: 64.00

Servicewide Issues : C47 (STORAGE)
C49 (ENVIRONMNT)

Cultural Resource Type: COMB (Combination)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

Storage of curatorial objects has been a long-standing problem throughout the National Park Service. Historically, the primary repositories for the collections at Hot Springs were designated without preparation of the sites for proper storage of artifacts and archives. Few artifacts or archives received conservation treatment or even adequate cleaning when they came into the collections. The collections have been scattered, poorly organized, and frequently moved; as a result, artifacts have suffered a great deal. Some have been damaged or even lost. Conditions within the storage areas were chaotic when the current museum technician came on board. Many items were stored in acidic containers (or no containers) in substandard spaces; many objects were not marked with catalog numbers; catalog records had not been updated with new locations when objects were moved, etc. In the last two or three years, much has been accomplished in this area, but the work is not yet finished. For several years, most of the furnishings in the collections have been stored in the Medical Director's Residence (MDR), which is not currently heated, cooled, or humidity controlled. The MDR is supposedly accessible only to museum staff, but the lock has been changed many times to allow workmen to unlock it and store bathroom or other building components there. These were mixed with collection objects. Since some of the latter were never marked with catalog numbers, it has sometimes been difficult to tell what is in the collections and what is not. The house is evidently open to small mammals because there are recurring infestations of fleas; the basement floods occasionally, and the roof over the living room leaks badly. The house is permeated with the smell of mildew and animal urine. The building (formerly the Superintendent's quarters) is currently slated for demolition. The University of Arkansas was a former repository for some archival items, but the storage space there was

not completely climate controlled. The archives were brought back to the park for processing and microfiching. Once this is complete, the University may have finished the upgrading of its Special Collections storage spaces and might be willing to redeposit them if finding aids have been written. However, the Special Collections construction project will not be completed for at least two years. The park now has two dedicated, access-controlled storage areas that are environmentally stable. The coldest, on the second floor of the Fordyce Bathhouse, contains large archival collections; textiles; museum storage cabinets of small artifacts, natural history specimens, art work, maps, archeological artifacts, and signs; documentary artifacts including photographic images and nitrate negatives; and a few pieces of wooden and wicker furniture. Most of the items are now cavity-packed, covered, or otherwise stored in accordance with NPS guidelines. However, a few problem areas remain, chiefly concerning unprocessed maps and blueprints. The second controlled area, an outdoor Bally building recently constructed, contains metal furnishings, glassware (mostly light fixtures), some wooden and wicker furnishings, large free-standing objects such as hair dryers, and large exercise equipment. It will also be used to house the Maurice stained glass when it is ready for transfer from the MDR. A few objects, mostly stained glass panels, remain in the MDR. The 1993 Collection Storage Plan made provisions for more collections storage in an environmentally controlled area in the Lamar Bathhouse (the originally planned location for the Bally building), but until the ultimate function for that building is established, it would not be advisable to place more collection items into it. A third permanent alternative storage area needs to be provided to hold the rest of the current collections and to allow for its limited expansion. Finally, the 3-story (plus basement) Fordyce Bathhouse is a restored bathhouse which contains nearly 1,000 artifacts in exhibit areas. These are at risk due to inadequate environmental controls in the building and to lingering security gaps. The Fordyce is not sealed and responds to every change in the outside humidity; in the winter, RH has been known to fluctuate as much as 60 percentage points in a single day. These rapid fluctuations cause the building's plaster to deteriorate and wood veneers to crack. Wooden collection objects also become dry; one table has developed a long crack, and the veneers on cabinets are splitting. Wicker furnishings are also dry and very brittle in the winter. Other problems with the current HVAC system sometimes result in greatly increased humidity in the building; low temperature settings combined with high absolute humidity have occasionally caused so much condensation that it appeared to be raining in some areas of the building as water dripped from ceiling beams onto the furnishings and floor. Ultraviolet light represents another environmental threat; a number of windows in the building allow bright sunshine into exhibits of clothing and/or paper objects. Security in the Fordyce has improved greatly in the last two years, but a few problems still remain. Formerly accessible only through Ranger-led tours, the building now is viewed via self-guided tours. Rails and other barriers have been erected to keep people out of exhibit areas, but they are easily breached, and

there is insufficient staff to properly monitor the areas. An alarm system is now in place, which has reduced (but not eliminated) loss of objects through theft. Responding personnel must often come from two or three floors away to reach the breached area and often are too late to prevent tampering. These personnel are not commissioned and can only issue verbal warnings. The gymnasium and assembly rooms probably represent the greatest problem in this respect; objects continue to be tampered with in these areas. Other problem areas include the women's needle shower on the first floor; visitors have several times torn the door from its hinges, and at least one part has been stolen from the water control plumbing unit. We are working on obtaining a plexiglass barrier for this area. Plexiglass barriers would be easily placed and very useful in the massage rooms and the electro-mechano-therapy room as well.

Description of Recommended Project or Activity

1. ASSIGN A THIRD MAINTENANCE WORKER TO THE FORDYCE BATHHOUSE. The Fordyce Bathhouse is a large public building with nearly 300,000 visitors a year. Although two maintenance workers are assigned to housekeeping in the building, they are not graded to be responsible for the basic maintenance that continually needs to be performed in a building of this size and importance. Plastering, painting, repairs of all kinds, electrical work, etc. will always need to be done. If at least one high level maintenance worker could be assigned responsibility for the Fordyce as his primary duty, someone would always be available for emergency repairs and for consultation.
2. OBTAIN ADDITIONAL STORAGE FOR REMAINING COLLECTION OBJECTS. All remaining artifacts need to be removed from the MDR, where they are now at great risk of being damaged by non-museum personnel and a variety of environmental threats. A second Bally building half the size of that already installed would house the remaining artifacts and allow adequate room for new collection items. Shelving to house the Maurice stained glass also needs to be ordered and put into place in the current Bally building.
3. CONTROL ENVIRONMENTAL INSULTS TO THE FORDYCE BATHHOUSE AND ITS FURNISHINGS. Unless both outer and inner walls can be sealed to prevent the transfer of air through the walls, humidity will never be completely controllable. Paint on the market today could provide a vapor barrier for the inner walls of the building; the next time these are painted, it would be advisable to prime at least some of them with such a paint in order to test the appearance over time. With the addition of humidity control to the current HVAC system, the extreme humidity fluctuations experienced in the past might be avoidable. To help control ultraviolet light damage to furnishings, the windows on the south side of the third floor need Lexan panels inserted between the glass window and the screen. These panels would not be visible from inside or outside. Plexiglas barriers would prevent theft and tampering in the second

floor ladies' parlor, massage rooms, and mechanotherapy room.

BUDGET AND FTEs:

-----FUNDED-----				
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
Total:			0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	MIT	One-time	64.00	0.40
Total:			64.00	0.40

(Optional) Alternative Actions/Solutions and Impacts

1. CONTINUE TO ALLOW VOLUNTEERS TO PERFORM MAINTENANCE IN FORDYCE BATHHOUSE. This solution has more or less been used for the last few years with varying success. Often qualified individuals are not available or do not stay long enough to provide continuity of projects. Less qualified volunteers have done the work at times, resulting in poor workmanship. The continual turnover of qualified workers has resulted in the misplacement of objects. In addition, many workers cannot understand the philosophy of historic restoration or NPS policies.

2. FIND MORE CURATORIAL STORAGE SPACE IN THE FORDYCE BATHHOUSE. As a less costly alternative to a Bally building, an exhibit storage room on the third floor, in combination with Room Q (dressing room), could be retrofitted for use as storage by adding curatorial locks, upgrading wiring, and installing dehumidifiers already on order. Old shelving from the M.D.R. could be repainted for use in this storage space.

3. CONTINUE WITH THE STATUS QUO IN ENVIRONMENTAL CONTROL AND MAINTENANCE OF THE FORDYCE. If this alternative is chosen, furnishings will continue to deteriorate and will eventually need to be replaced. Time and personnel from Maintenance Division and Southwest Regional Preservation will be increasingly needed to replaster and repaint walls, reglue veneer, plane doors, etc.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 C(17)

Project Statement

HOSP-C-010.001

Last Update: 03/15/95
Initial Proposal: 1994

Priority: 7

Title : ADMINISTRATIVE HISTORY
Sub-title: ESSENTIAL RESEARCH

Funding Status: Funded: 0.00 Unfunded: 150.00

Servicewide Issues : C37 (ADMIN HIS)

Cultural Resource Type: COMB (Combination)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

Without a professionally produced Administrative History the full extent of the government's role at Hot Springs Reservation (renamed Hot Springs National Park in 1921) cannot be comprehended. Much happened over many years here--the Federal Reservation was established in 1832, and the government was directly involved even before that. In 1804 President Jefferson sent an expedition under the command of Hunter and Dunbar to investigate the springs. An Administrative History of the park would be a formidable task, but the results would be worth it. Subjects to be addressed include: early exploration, federal land policies, Indian policy, public health intentions, interagency relations, development of concession policy, development of a coherent ethic concerning the conservation of resources as balanced with public use, public architecture and landscape, provisions for the poor, development of transportation, flood control, workings of Congress and Presidential Commissions, control of communicable disease, operations of regulatory boards, development of accommodations with the adjacent city, etc. Comparison to Banff in Canada and Yellowstone would be essential to full understanding of the government role in establishment of national parks and subsequent dissemination worldwide. Hot Springs Reservation served as a test case for the national park concept. By trial and error here, lessons were learned about proper management of parks that came later. A complete Administrative History would guide the park in its effort to manage according to historical perspective. The Administrative History is also a prerequisite to a park handbook in the Harpers Ferry Center series, which the park would like to see done.

Description of Recommended Project or Activity

Research and writing of the Administrative History should be undertaken by a qualified historian. A National Park Service professional could be assigned, or the job could be contracted to a university or college professor (preferably as a sabbatical project, to allow adequate time to be devoted). The researcher would be permitted access to the park's archives, many of them primary documents. To convey the enormity of this resource, it should be noted that the park's archival collection is approximately 250 linear feet in size; this figure does not include maps, photographs, and blueprints--which should also be examined, evaluated, and synthesized. In addition, several secondary sources might prove useful. Examples are "Out of the Vapors: A Social and Architectural History of Bathhouse Row", by Paige and Harrison, and an unpublished manuscript entitled "The Hot Springs of the Ouachita" by Cron. These are on file in the park library and would provide clues for ferreting out still more information. Since numerous laws pertain to the affairs of the park, records of Congressional hearings and court proceedings will demand scrutiny (especially in reference to the settlement of land claims). The close relationship of the park with the adjacent city has also engendered documents worthy of examination. Personal papers will be deemed relevant as well; Sam Fordyce, who enjoyed political connections reaching to the President of the United States, played a particularly leading role in park development.

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	
Total:			0.00	0.00
		-----UNFUNDED-----		
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	RES	One-time	75.00	1.00
Year 3:	RES	One-time	75.00	1.00
			=====	
Total:			150.00	2.00

(Optional) Alternative Actions/Solutions and Impacts

The Administrative History can continue to be put off, or there can be some edging up to the task with half-way measures. There can be

reliance on amateur writings that pass for legitimate studies, but which only scratch the surface and are misleading. There can be further dependence on oral tradition passed down by employees who have been here the longest. Research can continue on a piecemeal and ad hoc basis, as schedules permit. Until a formal Administrative History is done, the park's status as the true ancestor of Yellowstone, Yosemite, and other national parks will probably go unappreciated.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 B(4)

Project Statement
Last Update: 03/15/95
Initial Proposal: 1994

HOSP-C-011.001
Priority: 3

Title : HISTORIC RESOURCE STUDY/HISTORIC BASE MAP
Sub-title: COMPLIANCE W/CRM LAWS

Funding Status: Funded: 0.00 Unfunded: 75.00

Servicewide Issues : C35 (HRS)
C63 (HIS BASE MP)

Cultural Resource Type: COMB (Combination)

N-RMAP Program codes :

10-238 Package Number :

Problem Statement

Although considerable research and writing have been devoted to most aspects of Bathhouse Row and its immediate vicinity, little has been done on the park's other 5,000+ acres and the resources they contain. The completion of these studies would provide data for management, for interpretation, and for treatment recommendations. More importantly, the completion of these studies would allow the park to fulfill its legally mandated requirements under Section 110 of the National Historic Preservation Act, Executive Order 11593, and the American Indian Religious Freedom Act. Also, NPS-28 states: "All National Park Service areas possessing cultural resources must have an Historic Resource Study (Chapter 4, page 1)." Hot Springs National Park needs to meet this guideline.

Description of Recommended Project or Activity

The Historic Resource Study and Historical Base Map of Hot Springs National Park would include geographic areas of the park's 5,500+ acres outside of Bathhouse Row. The study would identify and evaluate all historic resources and include the collection, evaluation, synthesis, and presentation of data and research findings concerning the park's structures, sites, objects, districts, complexes, and historic functions. Topics covered would include the ethnohistory of the park's area including Native American and African-American settlements, the Civil War in and around Hot Springs, mining activities (especially pertaining to novaculite), the Public Health Service and Camp Garraday, important personages and their connection with significant events in the

geographic area, and the historic uses of Gulpha Gorge, Whittington Park, Hot Springs and West Mountains. Exact locations, if discoverable, would be shown for structures such as the first Observation Tower, Happy Hollow businesses, the second platform for the Angel Flight Trail, the Civil War state capitol, Civil War earthworks and graves (which are rumored to exist within park boundaries), old boundary monuments, old settlement sites now in the park, etc. Also covered would be the significance and location of related remains completely or partially outside the park--sanitariums, hotel bathhouses, cold water resorts, the Chewaukla Spring site, as well as residences and offices of doctors and other people directly involved with the historical spa, associated trash dumps, etc. All roadbeds and trails should be researched, including carriage roads, horse trails, railroad spurs, logging and mining roads, Indian trails, the Old Little Rock Highway, and hiking or exercise trails. Most exemplary in the latter category is the Oertel Trail System. Its history should be thoroughly researched and its design and use compared to Oertel Trails in Germany. This unique resource is a prime candidate for National Register and perhaps National Heritage Trail status, owing to the existence of documentation and the relative integrity the system enjoys (despite having been paved shortly after its creation). If, however, it is not fully appreciated, this integrity could be temporary; some of its trail markers have disappeared, and perhaps others should be collected for museum storage after proper clearances have been obtained. This is the sort of dilemma the Historic Resource Study could address. The Study would include an annotated bibliography. The Historic Resource Study would include evaluation for and possible additions to the National Register of Historic Places and additions to the List of Classified Structures for appropriate resources. This Historic Resource Study should be assigned to a competent professional, or team of professionals, with expertise in various disciplines: history, archeology, architecture, and so on. If the project is done in tandem with an archeological survey, it could substitute for the first phase of that survey as described in the Archeological Survey project statement of the current Resource Management Plan.

BUDGET AND FTEs:

-----FUNDED-----				
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	
Total:			0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	RES	One-time	75.00	1.00

Total:

=====

75.00

1.00

(Optional) Alternative Actions/Solutions and Impacts

To assign regular park staff to this complex project would probably not, despite good intentions, satisfy legal requirements as understood by experts in cultural resource management; hence, such an expenditure of time and effort is questionable. On the other hand, if this project does not happen, the park will continue to be out of compliance with federal mandates. The worst impact is that in the absence of accurate information, the park may be unable to protect its quite substantial cultural resources.

Compliance codes : OTHER ()
NHPA ((106) NAT. HIST. PRES.)

Explanation: Executive Order 11593

Project Statement
Last Update: 03/15/95
Initial Proposal: 1995

HOSP-I-001.001
Priority: 1

Title : ESTABLISH GIS FOR MONITORING RESOURCES AND LAND USE
Sub-title: GEOGRAPHIC INFORMATION SY

Funding Status: Funded: 27.50 Unfunded: 90.00

Service-wide Issues : N24 (OTHER (NATURAL))
C62 (GIS)

Cultural Resource Type: COMB (Combination)

N-RMAP Program codes : I00 (Interp. of Natural Resource Issues)

10-238 Package Number :

Problem Statement

Over the years the park has collected a vast amount of data. Managers must evaluate this information when making a broad range of decisions regarding park resources. The intensity of this evaluation process has become increasingly complex with the addition of impacts and influence from adjacent lands. To conduct this examination, one needs data about the resources and a system for storing, retrieving, and analyzing the data. Currently the park must rely upon various map resources, handmade schematics, and data that is located in many different files, formats, and locations. The end result is repetitive, time consuming searches that are of limited value for management. The ability to analyze data accurately under current conditions is often hampered. The components of a computerized land information system include the data to be analyzed, devices to enter data, means of storing the data, the computer hardware and software that perform the analytical functions, and a means of information output. The application of a Geographic Information System to manage problems stem from the ability of the system to store, sort, merge, edit, update, and analyze resource data according to the instructions of the system's operator. The implementation of a GIS can create, analyze, and display mapped information in a scale or detail needed from a different vantage point (e.g. zooming in). It can connect mapped information to attribute data. An example would be retrieving a map of park boundaries and being able to relate this to tract name, ROW's, land ownership, zoning, cultural and natural resources; etc. A GIS would be used to create new types of mapped information and analysis from updated themes and data, and could be used to predict trends and detect changes, e.g. changes in surrounding development of private lands, vegetation management, cultural resources management, etc.

Description of Recommended Project or Activity

The Park's Resource Management Specialist has already researched and purchased the hardware and software necessary to implement a GIS System. SPOT Satellite Data (Multi-spectral Scanner data) has been obtained of the Park as well. A high resolution color aerial photography mission was flown in February of 1996 and the imagery has been delivered to the Park.

The Resource Management Specialist is scheduled to receive necessary training on the new software in May. At that point, Hot Springs will have an operational GIS. Funding, however, will be required in order to digitize the aerial photography, establish GPS ground control points, and incorporate already available spatial information into a useable digital data base. That funding will be necessary on a continuing basis for several years.

Base maps on historic structures, wildlife and plant distribution, geology, soils, land use, trails, fire history, insect and disease induced defoliation, and a miriade of other thematic topics will be addressed by this new system.

The Park has recently been asked by the City of Hot Springs to enter into a multi-agency cooperative whose goal is an integrated county-wide GIS data base. The City and County as well as several major utilities are involved along with the National Park Service. Under the current plan, Ortho-rectified imagery at a nominal scale of 1": 100 ft. will be acquired with full GPS control points. The resultant products will allow the production of three dimensional elevation models with a contour interval of 1-2 feet and a miriade of other hypsographic, thematic map projections. All involved agency resources will be pooled and data products shared equally among participants. Park Service participation in this project will allow managers to make much more enlightened and perceptive policy decisions for years to come. It will also promote community involvement in our own management decisions and allow the Service to be part of the City and County's development policies as well.

BUDGET AND FTEs:

	Source	Activity	FUND TYPE	Budget (\$1000s)	FTEs
1994:	PKBASE-NR	ADM	One-time	5.00	0.10
	PKBASE-NR	RES	Recurring	22.50	0.20
		Subtotal:		27.50	0.30

=====

		Total:	27.50	0.30
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 3:	RES	Recurring	30.00	0.50
Year 4:	RES	Recurring	60.00	0.50
			=====	
		Total:	90.00	1.00

(Optional) Alternative Actions/Solutions and Impacts

No Action: If no action is taken to establish a state-of-the-art system of data gathering and analysis of park resources, informed decisions will not always be possible.

Continue Present Action: This alternative entails gathering of information by present resource managers as time and funding permits. The current level of inventorying and monitoring would continue, but with no systematic coordination or analysis of this data. The results are often incomplete, inconclusive, or poorly evaluated.

Develop a Resource Based GIS: This alternative would refine and expand the natural and cultural resources data base, providing up-to-date information through photography, sampling, research, and collection of literature and maps. Planning efforts would identify inventory requirements, select appropriate software and hardware components, and prioritize those activities which will necessitate funding requests and outside assistance. A Cooperative Agreement with the City of Hot Springs and associated County Agencies and Utilities will be implemented to produce a GIS Plan based on priorities identified by park resource personnel as well as other members of the GIS Cooperative. Through this alternative a valuable analysis tool will be available to managers (other agency personnel as well) that will assist them in many future decisions regarding the wise and appropriate management of Park Resources and will facilitate the Service's involvement in City and County development decisions as well.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.6

Project Statement
Last Update: 03/21/96
Initial Proposal: 1993

HOSP-N-001.001
Priority: 5

Title : MONITORING GEOTHERMAL SPRING FLOW REGIMES
Sub-title: ARTESIAN FLOW

Funding Status: Funded: 0.00 Unfunded: 56.00

Servicewide Issues : N10 (MINRL/GEOTHERM)
N20 (BASELINE DATA)

Cultural Resource Type:
N-RMAP Program codes : G00 (Geologic Resources Management)
G03 (Geothermal Resources Management)

10-238 Package Number :

Problem Statement

The flow of the springs has been measured irregularly throughout the park's history. Individual springs fluctuate seasonally and over the long term. Through time, some springs have ceased to flow and new springs have emerged. Some observed changes in crystalline structure of minerals deposited at the mouths of springs may indicate water temperatures are cooling over time. The park has never continually monitored the amount and condition of spring flow.

Congressional concern over the possibility of geothermal energy development affecting national park geothermal resources precipitated the passing of Public Law 99-591. Paragraph 2(b) of section 115 of that law requires a monitoring program be set up and maintained for each thermal feature determined to be a significant thermal feature. The springs at Hot Springs N.P. were determined to be a significant thermal feature.

In combination with Congress mandating a monitoring program, and concern that the thermal flow may possibly be decreasing and the water temperature cooling, the park installed a flow monitoring system. The project began development in 1986 with \$56,000 from the Fort Collins' Water Resources Unit. Designed by the park, SWRO scientists, Ft. Collins' Water Resources Unit and the U.S. Geological Survey, it involved the installation of two calibrated weirs at the main collection reservoir (under the Administration building). The weirs continuously monitor: 1) temperature and flow into the collection reservoir from the thermal springs connected to the collection system 2) the stage of the water in the collection reservoir and 3) flow from the collection reservoir into the underground creek arch when the NPS storage facilities are full.

Operated by the U.S. Geological Survey with support funding from the NPS, the system became operational May 1989 and is providing accurate data relating to flow and temperature of the springs collected, except for periods of failure in the data collection system. It is also allowing an evaluation of the contribution of the springs located at the bottom of the collection reservoir. Although data is only being collected on the 23 springs connected to the collection system, as the length of recorded observations increases, seasonal and longer term flow trends for the entire spring system will be established. Future analysis of the data will allow an evaluation of any detrimental effects to the thermal spring's hydrogeological system. In addition, accurate estimates of the total water available, at various times of the year, will give management better information to make thermal water allocation decisions.

Description of Recommended Project or Activity

Continue to monitor flow and temperature into the future. Continue to route all collected water through the monitoring wiers and avoid routing directly to the display cascade. Long term, continuous and accurate data records are absolutely essential because flow variations indicating recharge system conditions are probably spread over a long period of time. Valid trends will only be apparent after many years of monitoring.

BUDGET AND FTEs:

-----FUNDED-----				
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	
Total:			0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 1:	MON	Recurring	14.00	0.10
Year 2:	MON	Recurring	14.00	0.10
Year 3:	MON	Recurring	14.00	0.10
Year 4:	MON	Recurring	14.00	0.10
			=====	
Total:			56.00	0.40

(Optional) Alternative Actions/Solutions and Impacts

No action would halt data collection and analysis before an adequate amount of data is collected to provide information on long term changes in the amount of spring flow. The park would be in violation of Public law 99-951 and would not be following NPS policy of monitoring the park's primary natural resource.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.6

Project Statement
Last Update: 03/13/95
Initial Proposal: 1995

HOSP-N-002.001
Priority: 4

Title : CONTROL OF KUDZU & EXOTIC VEG IN HISTORIC DISTRICT
Sub-title: EXOTIC VEGETATION MGMT.

Funding Status: Funded: 5.50 Unfunded: 60.00

Servicewide Issues : N08 (CULT LANDSCAPE)
N05 (NON-NAT PLANTS)

Cultural Resource Type: CULL (Cultural Landscape)
N-RMAP Program codes : V00 (Vegetation Management)
V04 (Exotic Plant Management)

10-238 Package Number :

Problem Statement

The park contains a wide variety of non-native species. The elimination of all exotics from the park would be the preferred alternative but is not feasible. The park has identified certain species and areas as priorities for control action.

The top priority for control is a growth of kudzu (*Pueraria lobata*) above Arlington Lawn, covering the rock/masonry wall above the water cooling station and invading the newly redesigned thermal water cascade. The kudzu threatens to overtake new landscaping efforts and is highly visible to park visitors. Additional kudzu sites are found in natural zone lands and will continue to displace native vegetation. Because kudzu is so fast growing and will eliminate all other vegetation on a site it invades, it should be controlled where ever it is found in the park.

Maintenance of the lawns along Bathhouse Row in a "showcase" condition requires constant manipulation. Currently, the park is planning to treat the Arlington Lawn with pre-emergence herbicides for control of crabgrass and broad-leaf weeds. Present plans call for re-sodding the lawn at a future date with a fescue variety. Lawns and other landscaping in front of individual bahhouses will be addressed after rehabilitation of the buildings is completed.

Other priority areas for control include an area on West Mountain that was burned by a wildfire in 1982 and which has been invaded by the Princess tree (*Paulownia tomentosa*). Other areas of special concern for exotic removal are at the beginning of trail heads, and isolated pockets of disturbed areas that become invaded with exotics.

The following exotic plant species have been documented within the

park:

Vines:

Kudzu (*Pueraria lobata*)

Asian Wisteria (*Wisteria floribunda*)

Japanese Honeysuckle (*Lonicera japonica*)

English Ivy (*Hedera helix*)

Trees and Shrubs:

Mimosa (*Albizia julibrissin*)

Privet (*Ligustrum sp.*)

Princess Tree (*Paulownia tomentosa*)

Golden Rain Tree (*Koereateria paniculata*)

Past control actions have been sporadic and thus ineffective. In 1980, a crew of 30 YCC enrollees mechanically removed numerous exotic plant growths from the park. In the past 2 years, the one seasonal employee who conducts natural resources management has begun a program of heat-wilting some of the kudzu and other spreading exotics in the historic district. This heat-wilting hopefully will almost eliminate the need for application of chemical herbicides, especially in the thermal water recharge zone of the park.

Description of Recommended Project or Activity

Continue to research control techniques that will minimize the use of chemical herbicides. Our brief experience with heat-wilting vegetation shows that it has promise, but more intensive efforts are needed to effectually implement control.

BUDGET AND FTEs:

-----FUNDED-----					
	Source	Activity	Fund Type	Budget (\$1000s)	FTEs
1994:	PKBASE-NR	MIT	One-time	2.50	0.10
	TEMP\$-NR	MIT	One-time	3.00	0.00
			Subtotal:	5.50	0.10
			Total:	5.50	0.10
-----UNFUNDED-----					
		Activity	Fund Type	Budget (\$1000s)	FTEs
Year 1:		MIT	Cyclic	15.00	0.50

Year 2:	MIT	Cyclic	15.00	0.50
Year 3:	MIT	Cyclic	15.00	0.50
Year 4:	MIT	Cyclic	15.00	0.20
Total:			=====	
			60.00	1.70

(Optional) Alternative Actions/Solutions and Impacts

No action: This alternative will result in spreading of kudzu to cover the tall rock/masonry wall behind the water cooling station, impacting the integrity of the mortar. It will also allow the kudzu to spread and cover both sides of the newly-redesigned thermal water cascade.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.7

Project Statement
Last Update: 03/13/95
Initial Proposal: 1994

HOSP-N-003.001
Priority: 2

Title : RESTORATION OF HOME SITES & OTHER DISTURBED AREAS
Sub-title: LANDSCAPE RESTORATION

Funding Status: Funded: 0.00 Unfunded: 0.00

Servicewide Issues : N06 (LAND USE PRAC)
N22 (VIS USE-DEV ZN)

Cultural Resource Type: COMB (Combination)

N-RMAP Program codes : D00 (Disturbed Area Rehabilitation)

10-238 Package Number :

Problem Statement

The authorized boundary of the park encompasses approximately 5,543 acres; approximately 4859.77 acres of this are now owned by the U.S. Over 100 tracts of land now owned by the U.S. are subject to either term or life estate reservations by the former owners. As these estate reservations are extinguished, the park customarily disposes of any structures through surplus bidding procedures and restores the site to as natural a condition as feasible. In cases where there are adjoining property owners still in residence, the cleaned-up building site is sometimes maintained in a lawn-mowed condition. Demolition by a private contractor for homes that are not sold via bid is often the only way to eliminate these buildings; during FY1993 31 buildings were demolished via this process at a cost of \$ 108,000. This process is now much more costly due to required inspections for asbestos- and lead-containing materials and subsequent mitigation. These abandoned buildings are subject to vandalism, and are a maintenance and law enforcement burden. With respect to resources management the presence of foundation slabs and impenetrable driveways have a negative impact on the recharging of the thermal spring aquifer and need to be removed.

The restoration of old homesites will be a recurring project for the next twenty years or so, as various term and life estates are expired.

Other disturbed areas consist of two old roadways that the park uses for fire fighting access roads: the Stonebridge to Mountain Valley Cutoff road, and the Blacksnake to Cedar Glades road. These roads should continue to receive minimal maintenance to the extent that passage by a pickup truck is possible without vehicle damage.

A paved road leading from Blacksnake Road to the site of a previous ranger residence and inholder's residence serves no purpose and should be removed.

The Sour Rock Springs road leading to the summit of Music Mountain has been reclaimed and the abandoned park radio tower removed. Other radio towers are maintained on West Mountain inholdings for various private businesses.

The park has a past history of quarry operations. Most are small scale novaculite pits. Major man-caused earth disturbances have taken place at Loyd's gravel pit, Grave's gravel pit, and at leveled mountainside sites for municipal water storage tanks. The restoration of a naturally occurring grade is probably not feasible; slope stabilization can be improved by engineering design. In August, 1993 the Regional Director requested assistance from the Division of Surface Mining and Reclamation, Arkansas Department of Pollution Control and Ecology, in using funding from their monies received through Title IV of the federal Surface Mining Reclamation and Control Act to assist reclamation in the park.

Utility easements exist and cooperation to minimize necessary disturbances of the rights-of-ways should continue. Efforts should continue to have the existing railroad right-of-way donated to the U.S.

Description of Recommended Project or Activity

The park should seek funding to continue the program of structure removal and site restoration as unencumbered land tracts are acquired. Once several adjoining sites are acquired so that there is no longer an adjoining occupied residence, these sites should no longer be mowed as residential lots and should be restored to native vegetation.

Pursue efforts with the state Division of Surface Mining and Reclamation to obtain design and reclamation funding once higher priority projects on state lands are completed.

BUDGET AND FTEs:

		-----FUNDED-----			
	Source	Activity	Fund Type	Budget (\$1000s)	FTEs
1994:	PKBASE-OT	MIT	One-time	0.00	0.00

=====

		Total:	0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	MIT	Recurring	30.00	0.50
Year 3:	MIT	Recurring	30.00	0.50
Year 4:	MIT	Recurring	30.00	0.30
			=====	
		Total:	90.00	1.30

(Optional) Alternative Actions/Solutions and Impacts

No action would result in enlargement of the attractive nuisance and vandalism problem. Already, neighborhood groups have complained to the Superintendent about the eyesores of many dilapidated, abandoned houses belonging to the park.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.7

Project Statement
Last Update: 03/13/95
Initial Proposal: 1994

HOSP-N-004.001
Priority: 7

Title : INTEGRATED PEST MANAGEMENT
Sub-title:

Funding Status: Funded: 4.00 Unfunded: 36.00

Servicewide Issues : N04 (NON-NAT ANIMAL)
N06 (LAND USE PRAC)

Cultural Resource Type: COMB (Combination)
N-RMAP Program codes : H00 (Pest and Hazard Management)
H01 (Integrated Pest Management)

10-238 Package Number :

Problem Statement

Hot Springs National Park IPM program is complex, partly due to the interface with the City of Hot Springs. Several organisms are a nuisance or hazard to visitors, and the neighboring urban area introduces complicating factors into the park.

The exotic plantings along the Bathhouse Row Historic District are susceptible to a variety of insects and diseases which require control to maintain the aesthetic quality of the historic scene. The first phase of the landscape management plan included construction and planting activities that drastically impacted existing vegetation and resulted in new plantings to be cared for (including a new turf for Arlington Lawn). The second phase of the plan is about to begin; it will again disturb existing Bathhouse Row plantings, along with the Grand Promenade plantings. Because of the complexity, the vegetation management of the Historic District will be guided by a separate plan which has been drafted by Dr. John Robinson and is now under review.

Of particular concern are the Magnolia Trees lining bathhouse row. The trees in the past have been weakened by attacks from scale insects, termites and by contact from out of control vehicles. The 1990 replacement of the sidewalk and curbs in front of the bathhouses caused some root damage. In addition, approximately 6 inches of fill and grass sod were placed on top of the tree's roots. Four of the trees on Bathhouse Row are now showing severe thinning in their crowns. The trees will be carefully monitored for signs of decline.

Starlings and house sparrows frequently nest on buildings in the area, but to date are not a serious problem. The pigeon population in the downtown area probably numbers several hundred; some

undoubtedly are diseased and suffering from foot pox and other diseases common in high population densities. Pigeon manure on historical buildings is a continual problem. The pigeon problem is aggravated by feeding done by various older visitors in the park and the surrounding city.

In July 1975, an outbreak of histoplasmosis occurred at the Garland County Courthouse in downtown Hot Springs. The infection apparently was caused from workers removing pigeon guano from the courthouse roof. Sixty-eight cases were confirmed, some to persons who only made brief visits to the building. The Arkansas Department of Health, in conjunction with the city, began pigeon control via baiting with strychnine-treated corn. The park has not participated in the poisoning program. Current park efforts in pigeon control are centered on destruction of eggs and nests found in sheltered areas, and attempts to build in physical barriers. As part of the rehabilitation project of the Fordyce Bathhouse, a monofilament nylon line was strung around the top of the building to discourage roosting pigeons; success was marginal, since the line broke (apparently due to weakening from ultraviolet exposure) and has not been repaired. In 1979, approximately 78 eggs were destroyed and 17 birds trapped in a very labor-intensive operation; in 1986 approximately 35 eggs were destroyed. Some pigeons are removed by direct reduction during nighttime patrols by the ranger staff.

Dogs and cats are frequently encountered in the park, especially in the suburban areas. They are not usually a serious problem, and attempts are usually successful in capturing them and transferring them to the city animal shelter. Feral cats do represent an active threat to park wildlife and occasional direct control in more remote areas is performed by the rangers.

Cockroaches are a problem in the administration building, the Fordyce Visitor Center, and all the warm, damp bathhouses. Sticky traps are used to monitor population levels and in the past control was achieved through the use of crack and crevice treatment with boric acid. In the summer of 1988, a dusting of boric acid was placed behind the sheetrock walls in the basement of the Fordyce Visitor Center. The 1990 flood inundated the basement and washed away the chemical. If the problem returns, boric acid will again be dusted behind constructed walls. When the rehabilitated administration building is opened this spring, that area will be monitored for needed controls.

Public encounters with rats on the Arlington Lawn and the Grand Promenade have occurred in the past but have not been documented recently. The absence of recent rat encounters could be the result of a general clean up of the downtown area. Several of the park buildings were tested for mouse/rat presence due to the hantavirus concern; no significant populations were found within any inhabited building.

A reoccurring problem is weeds that grow in the sand between laid

bricks in the Grand Promenade and create an unsightly condition. In the past the herbicide "Round-up" has been sprayed twice a year. Since 1989 the weed have not been sprayed but allowed to grow. Weeds growing where there is a lot of visitor traffic are kept low growing, while areas not receiving traffic were mechanically cut with a weed eater.

The cement slab and rock/masonry walls lining Whittington Creek were severely damaged in the flood of May 1990. Currently the remaining walls are subjected to structural damage from plant roots growing therein. In 1992, a heat-wilting program using a propane agricultural burner was begun; the program was not conducted enough to allow an assessment of effectiveness.

In 1984 the park attempted a bait/capture trap system atop the Mountain Tower concession to abate the end-of-summer infestation of wasps. The traps caught very few wasps, and the system was abandoned. The park has purchased cautionary signs for the concessioner to place in the tower lobby, advising of the wasp hazard.

In 1986 the park has experienced its first occurrence, in recent memory, of a significant attack by the Southern Pine Beetle. Many sites were detected in Garland County: in the park 14 sites were identified with over 550 infested and/or killed trees detected. In 1987, 37 infestation sites were located. In 1988, only 5 active sites were found and in 1989-90 only isolated beetle killed trees were observed. A separate analysis of this problem, its impact on adjoining commercial timber resources, of park and NPS policies and of attendant environmental concerns was documented in a Southern Pine Beetle Management Plan (Attached to this document as an appendix). The decisions made and actions taken are outlined in the plan.

Description of Recommended Project or Activity

The park should continue current IPM projects. An IPM manual has been received in the park; fiscal 1995 funding provided for a detailed re-write by the Regional IPM Specialist. As soon as the plan is received and reviewed by resource and management staff, it will become the Park's principal guidance document regarding all future IPM management policies and decisions.

BUDGET AND FTEs:

-----FUNDED-----					
Source	Activity	Fund Type	Budget (\$1000s)	FTEs	
1994:	PKBASE-NR	MIT	One-time	2.00	0.10
	TEMP\$-NR	ADM	One-time	2.00	0.00
			Subtotal:	4.00	0.10
				=====	
			Total:	4.00	0.10
-----UNFUNDED-----					
	Activity	Fund Type	Budget (\$1000s)	FTEs	
Year 2:	MIT	Recurring	6.00	0.20	
	ADM	Recurring	6.00	0.20	
			Subtotal:	12.00	0.40
Year 3:	MIT	Recurring	6.00	0.20	
	ADM	Recurring	6.00	0.20	
			Subtotal:	12.00	0.40
Year 4:	MIT	Recurring	6.00	0.20	
	ADM	Recurring	6.00	0.20	
			Subtotal:	12.00	0.40
				=====	
			Total:	36.00	1.20

(Optional) Alternative Actions/Solutions and Impacts

The "No Action" alternative would permit additional damage, some non-reversible, to both natural and cultural resources in the park.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.7

Project Statement

HOSP-N-005.001

Last Update: 03/21/96
Initial Proposal: 1994

Priority: 11

Title : SURFACE WATER QUALITY MONITORING
Sub-title:

Funding Status: Funded: 0.00 Unfunded: 56.00

Servicewide Issues : N11 (WATER QUAL-EXT)
N20 (BASELINE DATA)

Cultural Resource Type:

N-RMAP Program codes : Q00 (Water Resources Management)
Q01 (Water Resources Management)

10-238 Package Number :

Problem Statement

Surface water runoff in the park exists in Gulpha Creek (including three ponds in the Sleepy Valley subdivision and the Ricks pond), Bull Bayou and Hot Springs Creek.

Prior to 1986, the municipal sewer system line in Gulpha Gorge discharged effluent into Gulpha Creek above the park campground when heavy rains leaked into the main and caused backflow at the manholes. A portion of this system (from Park Avenue to the Sleepy Valley entrance) was renovated in the summer of 1986 to reduce this problem.

Also above the Gulpha Creek flow at Sleepy Valley, and outside the park is an abandoned stone quarry site with three settling ponds of saw lubrication oil. Because of the cost, this oil is commonly from used transformers. These ponds were tested for PCB levels in 1986: none was found in the water or the bottom sludge, and fatty fish tissues showed PCB levels that did not represent any public health hazard. No further action has been taken.

The Garland County landfill previously operated just a few hundred yards from Bull Bayou. During its operation, there was little control of materials individuals dumped at the site. The landfill closed early in 1990.

The Arkansas Department of Pollution Control and Ecology is responsible for the enforcement of water quality and ground water regulations. Currently, the state has classified all the park waters as secondary contact recreation. This is the lowest designation. There is no mention of the thermal springs or their recharge areas.

The park has an outdated water resources plan (approved 11/82). It was one of the first to be written and does not adequately address the park's water related issues.

In the past, there has been some monitoring of Gulpha Gorge Creek watershed, This information could be used as a limited baseline to compare additional measurements to. Currently, there is no monitoring of surface water quality in any of the three principal creek drainages.

Description of Recommended Project or Activity

Implement a water quality monitoring program to cover the three creek drainages, with professional analysis and interpretation, to provide data on all watersheds within the park. Encourage participation of U.S. Geological Survey work to be performed under the 1994 service-wide cooperative agreement. The sampling program would be designed for long term data collection. In addition, work with the Arkansas Department of Pollution Control and Ecology to have the known thermal spring recharge area identified on state water planning documents.

Request the water resources unit study the quantification of water rights within the park to assure adequate protection of government interest.

BUDGET AND FTEs:

-----FUNDED-----					
Source	Activity	Fund Type	Budget (\$1000s)	FTEs	
			=====	=====	
Total:			0.00	0.00	
-----UNFUNDED-----					
	Activity	Fund Type	Budget (\$1000s)	FTEs	
Year 1:	MON	Cyclic	12.00	0.30	
	RES	Recurring	4.00	0.10	
	Subtotal:		16.00	0.40	
Year 2:	MON	Cyclic	12.00	0.30	
	RES	Recurring	4.00	0.10	
	Subtotal:		16.00	0.40	

Year 3:	MON	Cyclic	12.00	0.30
	RES	Recurring	4.00	0.10
		Subtotal:	16.00	0.40
Year 4:	MON	Cyclic	8.00	0.20
		Total:	56.00	1.40

(Optional) Alternative Actions/Solutions and Impacts

"No Action" would result in the park being unaware of changes in the water quality of the surface waters of the park, and unable to document any decreases in water quality.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.6

Project Statement
Last Update: 03/13/95
Initial Proposal: 1994

HOSP-N-006.001
Priority: 8

Title : SENSITIVE SPECIES MANAGEMENT
Sub-title: THREATENED AND ENDANGERED

Funding Status: Funded: 0.00 Unfunded: 47.00

Servicewide Issues : N17 (BIODIVERSITY)
N03 (T&E PLANTS)

Cultural Resource Type: COMB (Combination)
N-RMAP Program codes : V00 (Vegetation Management)
V03 (Threatened & Endangered Plant
Management)

10-238 Package Number :

Problem Statement

Although the park is not known to contain any species federally listed as threatened or endangered, a number of species are presently known that require specific resource protection, and two areas have received special designations from the State of Arkansas.

As part of the 1988 rehabilitation of the Fordyce Bathhouse a concrete slab was poured for the electrical equipment at the southeast corner of the building. The pad impacted the drainage of a hot water seep a foot away. The disturbance resulted in the park funding a study of a minute crustacean that is found in the water and surface substrate. Darwinula sp. is apparently the same organism noted by William Dunbar and Dr. George Hunter in their 1804 expedition to the hot springs. Dr. M.S. "Doug" Bedinger, who is best known in the park for his part in the preparation of the 1979 U.S. Geological Survey Professional Paper 1044-C on the hydrogeology of the park's thermal springs, conducted sampling in most of the thermal waters of the park during August 1988. The samples were analyzed by Drs. R.M. Forester and E.D. Gutentag of the U.S.G.S. for the presence of Ostracods. Their preliminary report (received November 14, 1988) indicated that Darwinula sp. found at Hot Springs NP is known from other springs in the southwest United States, but has never been formally described or named. The species was found in at least 5 spring flows during the 1988 sampling. However, the sampling technique used was questioned and there is the possibility that Ostracods were transferred to various samples because of the sampling method. Further disturbance to the spring flow at the southeast corner of the Fordyce resulted in the park again sampling the park's seeps and springs (6/89). This time Dr Bedinger was joined by Dr E.D.

Gutentag. Telephone conversations with Gutentag have confirmed ostracods in the seep by the Fordyce but he has not had time to closely examine all the samples collected.

Treleases Blue-Green Algae (*Phormidium treleasei*), once reportedly found in all our free-flowing thermal springs, has been identified in North America only at Hot Springs National Park and at the Hot Sulfur Spring of Banff, Canada (but also occurs in Fukien Prov. China, Rotorua, New Zealand, Iceland and in the former Dutch East Africa). Since most of the hot springs here have been capped to prevent contamination and collect the water flows, habitat for the alga is limited to 2 open display springs, small sometimes seasonal seeps, the man-made (and in the past intermittent) Arlington Lawn cascade, and the thermal water fountains which are subjected to routine maintenance cleaning. Classification of algae is difficult; the park is fortunate to have the assistance of Dr Richard Meyer, a phycologist, at the University of Arkansas at Fayetteville. Dr Meyer last confirmed *Phormidium treleasei* at the park in 11/89. At that time he found it in three locations. It is his professional opinion that the park has a stable population of *Phormidium treleasei* at the display spring based on its presence there in 1982 and 1989.

The Arlington Lawn Cascade is the largest open thermal water display within the park. It has been modified in the first phase of the Landscape Management Plan. The modifications increased its width and created a number of pools, and waterfalls. After the construction is completed, (12/90), the park will permit natural migration to establish populations in the thermal waters.

The flora of the thermal water discharge zone has been almost completely altered to the point that little of the native flora remains. An exception are three calciphilic ferns that are still present on tufa exposures. The ferns are Venus Maidenhair (*Adiantum poplantioides*), Alabama Lip fern (*Cheilanthes alabamensis*) and Purple Stem Cliff Brake (*Pellea atropurpurea*) and were identified by Dr. Carl Taylor in a 1984 study. Dr. Taylor designated the area behind the Hale Bathhouse as critical habitat for the perpetuation of the ferns at Hot Springs. Although not uncommon in the limestone areas of the Ozarks, the ferns here should be protected to preserve the biodiversity of this isolated population and as a remnant of the native flora of the thermal spring discharge area. In 1990 the area behind the Hale was cleared of exotic and weedy vegetation. Care was taken not to damage the ferns and after clearing work, all three species were identified at the site. The Hale Bathhouse is planned to be under historic lease and there is the potential that future activity, including construction, will be going on in the area. All future activities will be evaluated with respect to impacts to the fern population.

In 1982 a mortality study of the Ozark Chinkapin (*Castanea ozarkensis*) was conducted to identify to what extent the species was being adversely affected by the chestnut blight. The chinkapin

is a species native to the Ouachita Mountains. Over the past few decades a significant decline has occurred in the population. The mortality in the park was estimated at eighty percent, consistent with infection rates of the blight on the American Chestnut tree. The Chinkapin is listed as a "category 1" plant species by the U.S. Fish and Wildlife Service, and may soon be listed as threatened or endangered. Twelve separate stands have been identified in the park, occurring predominately on north-northwestern slopes.

Grave's Spleenwort fern (*Asplenium x gravesii*) was discovered in the early 1980's and brought to the park's attention in 1982. This rare hybrid is known from only five other locations, all of which have been collected. The plant at the park is the only known record from Arkansas. Grave's Spleenwort, a hybrid between two other rare species, is sterile and never establishes a breeding population. The plant is thought to be the only plant taxa that contains the genes of the three basic species from which all Appalachian spleenworts are believed to be derived. The continued existence of this hybrid plant in the park was last confirmed in the spring of 1990 by Dr. Peck from the University of Arkansas at Little Rock. The location of the plant is not released to the public.

A volunteer researcher, Keith Horn, Northeast Louisiana University, conducted an inventory of fish in the park streams in September 1989. He collected a state sensitive species, the Ouachita Madtom (*Nocturus lachneri*). The location is a new one for the species. It has in the past been primarily limited to the Saline River drainage. Dr. John Harris, environmental scientist with the Arkansas Highway Department, is studying the madtoms to determine if the Saline and Ouachita fish are genetically distinct enough to be considered unique species or subspecies. If the two populations are separated, the Ouachita Madtom may be rare enough for federal protection.

An additional species is of interest. An algae eating fly (Ephydrid sp.) was collected over the springs many years ago, but an investigator in the mid 1980's failed to find it in the park; it was found only where Hot Springs Creek exits the underground creek arch about one kilometer downstream from the park. The park has made no recent attempts to determine the fly's occupancy or distribution in the park.

The special state designations related to the outstanding pine stands in the park and to the declaration of several trees in Whittington Park as candidates for "Champion Tree" status is as follows:

In 1982, the Arkansas Natural Heritage Commission designated approximately 300 acres of Sugarloaf Mountain and Hot Springs Mountain as a registered "Natural Area" because of the pine forest's "great age and more or less natural condition." This designation was followed by recognition in March 1983 by the Society of American Foresters of the 129 acre "Sugarloaf Pine

Stand". While neither recognition imposes any legal constraints on the park, they do indicate that the park contains several resources of outstanding value.

The Arkansas Forestry Commission has a "Champion or Big Tree" designation program in concert with the American Forestry Association's National Register of Big Trees. Several trees in the past have been designated champion trees in the past. A hazel alder (*Alnus rugosa*) on the west bank of Gulpha Creek south of the campground; an Arkansas black hickory (*Caryatexana arkansana*) growing on the Hot Springs Mountain spur road near the summit; and a yaupon (*Ilex vomitoria*) on West Mountain Drive. The most recent Champion Tree was a Florida Linden (*Tilia floridana*) in Whittington Park. This national champion was 10 feet 4 inches in diameter and approximately 350 years old when, in August 1983 it fell due to root rot, in spite of efforts to prolong its life.

Description of Recommended Project or Activity

Implement a protection program for the preservation and enhancement for the above sensitive species.

Among the recommendations are; the funding of a study to describe the ostracods found in the thermal springs and the environmental conditions under which it survives and reproduces. A taxonomic key and related monitoring equipment necessary for tentative algae identification should be obtained by the park staff. Also, an investigation into the occurrence of the Ephydrid sp. and its life history, ecological significance, and potential for successful reintroduction (if extirpated from the park). In addition, confirm the re-establishment of ferns and other native plant species in the cascade area.

Control of the Chestnut blight organism is not possible. However, the fungus does not attack trees until they reach a certain age and size. Proper monitoring and management can aid in obtaining significant resource information, and maintaining an immature population within the forest. Dr. Gary Tucker, Ozark National Forest is writing a species management plan for the Chinkapin on national forest lands. The park has received a copy of the draft report. Immature Chinkapins still exist (August 1990) in the park but to what extent the population has continued to decline is unknown and if there are still blight free reproductively mature Chinkapins is unknown. An attempt should be made to insure that the Chinkapin is not eliminated from the forest.

The Grave's Spleenwort plant should be monitored regularly. A permanent record of photography, surrounding environmental conditions and general health of the plant should be maintained.

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
Total:			0.00	0.00
		-----UNFUNDED-----		
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 1:	RES	One-time	18.00	0.30
Year 2:	RES	One-time	12.00	0.20
Year 3:	MON	Recurring	8.50	0.10
Year 4:	MON	Recurring	8.50	0.10
Total:			47.00	0.70

(Optional) Alternative Actions/Solutions and Impacts

A "No Action" alternative would result in degradation of known sensitive species, loss of diversity, and would be counter to preservation statutes, NPS management policies and guidelines.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.6

Project Statement

HOSP-N-007.001
Priority: 9

Last Update: 03/13/95
Initial Proposal: 1994

Title : VASCULAR PLANT SURVEY
Sub-title: INITIAL VEGETATION SURVEY

Funding Status: Funded: 0.00 Unfunded: 125.50

Servicewide Issues : N20 (BASELINE DATA)
N17 (BIODIVERSITY)

Cultural Resource Type:

N-RMAP Program codes : V00 (Vegetation Management)
V01 (Native Terrestrial Plant Management
and Monitoring)

10-238 Package Number :

Problem Statement

Many aspects of the vegetation of Hot Springs National Park have been studied. However, most work dates from before the 1950's, and therefore does not include the boundary expansion or the minor boundary deletions of 1993. The more recent work has centered on Hot Springs Mountain, and the thermal springs discharge area to address specific impacts of construction and park development projects. Dr. Edward E. Dale prepared a vegetation community analysis for Hot Springs but did not go into detailed analysis of the vascular plants.

Research by the nearby Ouachita National Forest, the Arkansas Natural Heritage Commission, and the Arkansas Nature Conservancy have documented a very diverse flora in the Ouachita Mountains which include some species endemic to the mountain range. Based on this research the forest has identified 66 species of special concern, many of which are proposed for Federal listing.

The park does not have a vascular plant survey. This is a serious void in the resources base inventory of the park. A survey would identify the location of species rare and endangered, identify threats to their continued existence in the park, and provide recommendations on their management.

Description of Recommended Project or Activity

A vascular plant survey of Hot Springs National Park should be conducted. The survey should utilize the current available

information on species identified as sensitive by the U.S. Forest Service. The survey should include spring and fall months to insure the flowering schedule of all species are covered.

This survey is an ideal candidate to be conducted, or at least designed and coordinated by the newly-formed National Biological Survey.

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
Total:			0.00	0.00
		-----UNFUNDED-----		
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 1:	MON	Recurring	27.00	0.70
Year 2:	RES	Recurring	9.00	0.30
	MON	Recurring	27.00	0.70
Subtotal:			36.00	1.00
Year 3:	MON	Recurring	27.00	0.70
	RES	Recurring	9.00	0.30
Subtotal:			36.00	1.00
Year 4:	MON	Recurring	20.00	0.40
	RES	Recurring	6.50	0.20
Subtotal:			26.50	0.60
Total:			125.50	3.30

(Optional) Alternative Actions/Solutions and Impacts

A "No Action" alternative would fail to address a basic need for baseline information in the park, and would be counter to NPS Management Policies and philosophy.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.6

Project Statement

HOSP-N-008.001

Last Update: 03/13/95
Initial Proposal: 1994

Priority: 10

Title : TRAILS MANAGEMENT PLAN DEVELOPMENT
Sub-title: RESOURCE PROTECTION

Funding Status: Funded: 0.00 Unfunded: 0.00

Servicewide Issues : N24 (OTHER (NATURAL))
N18 (VIS USE-BCTRY)

Cultural Resource Type:
N-RMAP Program codes : N00 (Resource and Visitor Use
Management)
N03 (Frontcountry Trail Patrol)

10-238 Package Number :

Problem Statement

The park contains approximately 18 miles of walking and hiking trails. Information on the park's trails, present and historic, has been researched and collected in a binder. Information contained in the binder includes: trail length, a trail map, general condition, and a photograph of all signs.

The degree of use and maintenance of the trails varies widely. The Magnolia Promenade, Grand Promenade, and other sidewalks in the Historic District are hard-surfaced and well maintained. The Magnolia Promenade sidewalk was completely resurfaced in 1990 as part of the first phase of the Landscape Management Plan. Most of the Grand Promenade is surfaced with bricks laid on a cement base, with only loose sand between bricks. This creates a hazard for catching high-heeled shoes and tripping because of the loose and washed out gaps between bricks. The loose sand also creates an unsightly condition from grasses and weeds growing between the bricks, and the loose bricks are occasionally pulled out and thrown by vandals. Visitor use of the Grand Promenade is approximately 190,000 people per year.

Other trails on Hot Springs Mountain receive much less use. They basically lead around the side of the mountain, from Bathhouse Row up to the Mountain Tower concession atop the mountain, and down the far side of the mountain to the Gulpha Gorge campground. These dirt and gravel trails receive some minor erosion after hard rains. Repairs after the May 1990 flood have all these trails' surfaces in good condition; recurring maintenance since then have kept them in excellent condition. Signing on these trails is somewhat confusing and a few of the signs have suffered minor vandalism; two are completely missing. A free, locally produced trail map is

available at the Visitor Center; the newly revised park brochure includes a map of the trail system and is also available at the Visitor Center.

A trail from the campground up Indian Mountain to an abandoned modern novaculite quarry and a prehistoric Indian quarry is along an old roadbed. The 1990 flood exacerbated the erosion problem on the trail, but it has since been repaired using flood project funds.

The West Mountain trails basically lead around the sides of the mountain. Again, since the post-flooding repair work, this system is in good condition.

The most extensive and least-used trail is the Sunset Trail leading in a complete circle about 9 miles across West Mountain, Sugarloaf Mountain, Blowout Mountain, and back to connect with the Hot Springs Mountain trails at the Gulpha Gorge campground. The trail is rough in places, but the improvements made seem suitable for the isolated cross-country type of hiking it offers.

Currently, the Historic District walkways and trails receive extensive maintenance and are in excellent condition. Other hiking trails on Hot Springs Mountain and West Mountain receive maintenance a few times a year, to repair erosion and remove hazardous trees; they too are in very good condition.

Description of Recommended Project or Activity

Continue the high maintenance standard on walking and hiking trails in the Historic District. Continue to seek historical approval and funding to set the Grand Promenade bricks in mortar and remove the loose sand. Continue to monitor trail condition for effects caused by horse use, and continue to enforce prohibitions on use of mountain bikes.

BUDGET AND FTEs:

		-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
1994: PKBASE-OT MIT		One-time	0.00	0.00
Total:			0.00	0.00

-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	PRO	Recurring	7.50	0.20
	MIT	Cyclic	18.00	0.60
		Subtotal:	25.50	0.80
Year 3:	PRO	Recurring	7.50	0.20
	MIT	Cyclic	18.00	0.60
		Subtotal:	25.50	0.80
Year 4:	PRO	Recurring	7.50	0.20
	MIT	Cyclic	18.00	0.60
		Subtotal:	25.50	0.80
			=====	
	Total:		76.50	2.40

(Optional) Alternative Actions/Solutions and Impacts

"No Action" alternative would allow existing trails to become safety hazards to the hiking park visitors.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM6 APP. 7.4 C(3)

Project Statement
Last Update: 03/14/95
Initial Proposal: 1994

HOSP-N-009.001
Priority: 1

Title : BOUNDARY/ENCROACHMENT
Sub-title: RESOURCE PROTECTION

Funding Status: Funded: 0.00 Unfunded: 69.00

Servicewide Issues : N06 (LAND USE PRAC)
N16 (NEAR-PARK DEV)

Cultural Resource Type: COMB (Combination)
N-RMAP Program codes : E00 (Environmental Planning and
Compliance)

10-238 Package Number :

Problem Statement

The boundary of Hot Springs National Park, including the 1938 park expansion, has been surveyed except for some minor gaps. Major survey work has been done in 1838, 1840, 1879, 1930, and 1973. However, many monuments are missing and some intervening signing is gone. Any re-monumenting should be performed and platted by a registered land surveyor for legal effect. Another minor boundary adjustment was enacted by Congress in 1993 (PL-103-58) and this has created a new boundary to be surveyed. Lack of a definitive boundary line makes actual encroachment impossible to identify and causes some confusion between law enforcement agencies because of the park's exclusive federal jurisdiction.

An intriguing problem exists when the as-maintained property line does not match the long-established meets-and-bounds surveyed line. Some examples: the survey-described boundary at Whittington Park is often up onto the park lawn, and often out into the city street. The boundary line along Bathhouse Row is sometimes several feet out into the state highway. The boundary line along Fountain Street runs approximately down the middle of the park's sidewalk; the park maintains the trees between the sidewalk and the city street, and has paid tort claims arising from falling tree limbs. The surveyed boundary around the Libbey Memorial Physical Medicine Center generally runs down the middle of the park sidewalk; the thermal water jug fountain is several feet out of the park's boundary. Resulting from land-use compromises with the city over more than a century of development, it seems impractical to adjust the survey boundary to meet the actual curb line.

A significant threat to the park is the practice by neighboring commercial landowners of excavating the toe of the park mountains to make a level, developable lot of their property. These

mountainside cuts, frequently unbuttressed, allow accelerated land sloughing due to the loss of lateral support at the man-made earth cuts. In 1963 the boundary land behind the Aristocrat Motel sloughed off and park land was lost. In December, 1968, a major rockfall of park land onto the DeSoto Hotel parking lot buried 3 unoccupied vehicles and damaged several others. In 1985, a large sloughing occurred adjacent to the Arlington Hotel but away from the park boundary; a portion of the Arlington's parking lot was covered by boulders up to 10 feet in diameter. Some of the boundary monuments have been lost when the land they sat on sloughed down the hillside. This problem is perhaps currently most critical at the park boundary with the Burton-Eisele Clinic on Whittington Avenue (currently being purchased for development into a hotel). In 1985, the gunnited wall behind the Burton-Eisele Clinic parking lot fell and park land was lost. No lateral supports mechanisms replaced the gunnite. The 1990 flood caused a relatively small landslide on the unsupported cut at the clinic's parking lot. The park has advised the owners of their legal responsibility to provide for lateral support, but has not yet received a reply. Other comparable situations are developing behind the Park Hotel, behind the Downtowner Motel Hotel, behind the DeSoto Hotel, on Central Avenue next to the Medical Arts building and along Fountain Street properties. A memorandum sent August 8, 1980 by the Southwest Region Field Solicitor confirmed that lateral support is an enforceable property right, but to date the park has not pursued legal proceedings.

Each year the park conducts some boundary line clearing and posting of signs. On those lines checked, several monuments generally are missing. In 1990 in cooperation with the Arkansas State Forestry Commission, the property shared with Hot Springs City Waterworks land was re-marked.

Description of Recommended Project or Activity

A licensed survey crew should be contracted to re-set missing monuments after they have been identified by park personnel. Basic clearing of the line between monuments and posting of intervening signs should be an on-going program at the park.

In August 1993 the authorized boundary was adjusted by Congress; to prevent trespass development this new boundary should be marked by a registered land surveyor.

The park staff should continue to document existing and potential threats from eroding cuts and require mitigating action from adjoining landowners. Legal precedent has been established (Park Hotel) to require this action. Appropriate city planning departments should be contacted to ensure no additional threatening construction is approved; if destruction of NPS lands appears imminent, an action for an injunction to force restoration of

lateral support should be considered.

BUDGET AND FTEs:

-----FUNDED-----					
Source	Activity	Fund Type	Budget (\$1000s)	FTEs	
			=====		
Total:			0.00	0.00	
-----UNFUNDED-----					
	Activity	Fund Type	Budget (\$1000s)	FTEs	
Year 1:	MIT	Cyclic	8.00	0.20	
Year 2:	MIT	Cyclic	8.00	0.20	
Year 3:	MIT	One-time	45.00	0.20	
Year 4:	MIT	One-time	8.00	0.20	
			=====		
Total:			69.00	0.80	

(Optional) Alternative Actions/Solutions and Impacts

A "No Action" alternative would prevent the park from protecting its own resources, as definite boundaries must be established to determine trespass activities.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.4

Project Statement

HOSP-N-012.001

Last Update: 03/21/96
Initial Proposal: 1994

Priority: 15

Title : THERMAL SPRING RECHARGE DELINEATION STUDY
Sub-title: GROUND WATER MONITORING

Funding Status: Funded: 0.00 Unfunded: 1250.00

Servicewide Issues : N10 (MINRL/GEOTHERM)
N20 (BASELINE DATA)

Cultural Resource Type:

N-RMAP Program codes : Q00 (Water Resources Management)
Q01 (Water Resources Management)

10-238 Package Number :

Problem Statement

The park has a long history of scientific interest and study regarding the thermal springs, beginning in 1804 when President Thomas Jefferson commissioned a study by William Dunbar and George Hunter. Currently, the definitive work on the springs is the 1979 Professional Paper by the U.S. Geological Survey, entitled The Waters of Hot Springs National Park - Their Nature and Origin. It addresses the age of the thermal waters, the amount of flow, levels of radioactivity and chemical concentrations and the geographical heat source of the hot springs. The study delineated the recharge zone of the springs as being primarily Arkansas Novaculite and Bigfork Chert Outcrop areas above 700 feet (213.4 m) mean sea level.

This paper proposed that additional studies be conducted to establish the actual physical extent and characteristics of the hydrologic system that circulated the water down to the thermal mass and then upward to the springs. A study of this magnitude would provide basic research of the park's primary resource, and important information on the recharge boundary for park management decisions. Included as part of this study, USGS and the NPS Water Resources Division recommended a monitoring program of well water withdrawal within the recharge area, and the drilling of observation wells to monitor ground water level variations with time and other factors. Also recommended are deep geologic test wells to provide information on the geology controlling the flow network and dynamics. In order to provide the professionalism and the continuity needed for such a long-term study, it is proposed that the work be done by the U.S. Geological Survey.

Description of Recommended Project or Activity

When funding becomes available, work with the USGS in implementing a study which would include deep well drilling to establish specific strata declination and the relationship to the spring recharge area, and subsequent monitoring of the ground water level in these and other nearby well systems. The proposed study would conform to NPS policy by providing an accurate, scientific basis for planning and future management decisions.

BUDGET AND FTEs:

-----FUNDED-----					
Source	Activity	Fund Type	Budget (\$1000s)	FTEs	
			=====		
Total:			0.00	0.00	
-----UNFUNDED-----					
	Activity	Fund Type	Budget (\$1000s)	FTEs	
Year 1:	RES	Recurring	250.00	0.00	
Year 2:	RES	Recurring	750.00	0.20	
Year 3:	RES	Recurring	250.00	0.20	
			=====		
Total:			1250.00	0.40	

(Optional) Alternative Actions/Solutions and Impacts

If no advances are made in this highly academic project, continue to rely on information contained within the 1979 professional paper. Management will make land use and other decisions possibly effecting thermal resources without a complete understanding of the thermal water recharge system.

Compliance codes : EIS (ENV. IMPACT STATEMENT)

Explanation: N/A

Project Statement
Last Update: 03/15/95
Initial Proposal: 1994

HOSP-N-013.001
Priority: 13

Title : DEVELOPMENT OF A FIRE MANAGEMENT PLAN
Sub-title: FIRE ECOLOGY

Funding Status: Funded: 2.00 Unfunded: 48.50

Servicewide Issues : N07 (NAT FIRE REGM)
N24 (OTHER (NATURAL))

Cultural Resource Type:
N-RMAP Program codes : F00 (Prescribed Fire Management)
F01 (Prescribed Burn Operations)

10-238 Package Number :

Problem Statement

Because of this urban park's interface with commercial properties and residential homes, fire planning has a critical role. A contracted study completed by Dr. Forrest Johnson and Gary Schnell in 1985 showed the normal fire return interval - before modern suppression activities began - to be 32 years. In Dr. Johnson's opinion, the most significant role of fire in the park ecosystem is as a controller of plant community composition. Returning to a natural burn pattern with such high-valued neighboring properties is not feasible. The park strategy is to suppress as soon as possible any fire that may be a threat to neighboring lands or structures, aided by the City's structural fire department capabilities, and the various volunteer branches of the Arkansas Forestry Commission fire fighting team.

Presently the park has a 4-wheel drive pickup truck with a slip-on pumper. This rig does not have a rating as a fire fighting unit. Although the truck is old and should be replaced for reliability, it seems adequate for in-park use; fires that can be reached from the roadways are quickly handled by the professional city fire department. The FIREPRO "standard California brush rig" was returned, since the F700 Ford truck was too large for the park's primitive fire roads, and too large to be stored in any of our garages.

A Fire Management Officer position has been funded for the Arkansas parks. The position is duty stationed at Buffalo National River and the majority of his duties are in support of Buffalo's prescribed fire program. He is available for technical support for Hot Springs; currently he is preparing the park's Fire Management Plan.

Description of Recommended Project or Activity

Continue the existing cooperative fire suppression efforts with the City of Hot Springs, the Arkansas Forestry Commission and Ouachita National Forest.

Continue to train and equip appropriate park personnel to maintain an in-house initial attack and normal control capability. Monitor daily fire danger in conjunction with the U.S. Forest Service during the park's fire season.

BUDGET AND FTEs:

			-----FUNDED-----		
Source	Activity	Fund Type	Budget (\$1000s)	FTEs	
1994: PKBASE-NR	MIT	One-time	2.00	0.10	
			=====		
Total:			2.00	0.10	
			-----UNFUNDED-----		
	Activity	Fund Type	Budget (\$1000s)	FTEs	
Year 1:	MIT	Recurring	35.00	0.10	
Year 2:	PRO	Recurring	4.50	0.10	
Year 3:	PRO	Recurring	4.50	0.10	
Year 4:	PRO	Recurring	4.50	0.10	
			=====		
Total:			48.50	0.40	

(Optional) Alternative Actions/Solutions and Impacts

A "No Action" alternative would unacceptably endanger neighboring commercial and residential property and life.

Compliance codes : EA (ENV. ASSESSMENT)

Explanation: EA done for Fire Mngmt plan

Project Statement

HOSP-N-014.001

Last Update: 03/15/95
Initial Proposal: 1994

Priority: 14

Title : AIR QUALITY MONITORING PLAN
Sub-title: AIR QUALITY MONITORING

Funding Status: Funded: 0.00 Unfunded: 442.80

Service-wide Issues : N20 (BASELINE DATA)
N14 (AIR POLLUTION)

Cultural Resource Type:

N-RMAP Program codes : A00 (Air Resources Management)
A01 (Air Quality Management)

10-238 Package Number :

Problem Statement

The Clean Air Act established National Ambient Air Quality Standards, and set more stringent limitations on the amount of air quality degradation that would be permitted in areas already meeting the NAAQS. Mandatory Class I areas (wilderness areas, national memorial parks over 5,000 acres, and national parks over 6,000 acres as of August 7, 1977) are permitted very little additional air quality deterioration; Class II areas (such as Hot Springs National Park) are permitted moderate air quality deterioration.

The park's air quality is affected by the products of its urban surroundings: motor vehicle exhaust pollutants and gasses/particulates from stationary sources. In addition, the surrounding commercial and private timber and pasture land managers conduct major controlled burn operations in the fall and spring, causing such smoke pollution that visibility of nearby mountains is sometimes completely lost.

The viewing of scenic vista at West Mountain and the Hot Springs Mountain Tower is an important part of the visitor's park experience. Currently, no baseline data are collected on air pollution, visibility or other air quality related values.

Description of Recommended Project or Activity

Continue to monitor proposed industrial developments for their potential detrimental effects to the park's air quality. Provide input to the state, and the NPS Air Quality Division regarding park

concerns. Work with the NPS Air Quality Division to document the visibility of distant landmarks from the Hot Springs Mountain Tower (or another important vista in the park) to provide a baseline on the park visibility. Correspondence received in September 1993 recommended purchase of a transmissometer/nephelometer, an automated camera, and a fine particulate sampler for approximately \$ 99,800. Additional estimated contractor support costs are \$ 78,000, and will also permit monitoring of air quality, acid precipitation, and meteorological monitoring.

Collection of adequate, defensible data will require purchase of complex equipment, and dedication of manpower that does not now exist.

BUDGET AND FTEs:

-----FUNDED-----				
Source	Activity	Fund Type	Budget (\$1000s)	FTEs
			=====	=====
Total:			0.00	0.00
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 1:	MON	One-time	99.80	0.00
	RES	Recurring	78.00	0.00
	MON	Recurring	7.00	0.20
Subtotal:			184.80	0.20
Year 2:	RES	Recurring	78.00	0.00
	MON	Recurring	8.00	0.20
Subtotal:			86.00	0.20
Year 3:	RES	Recurring	78.00	0.00
	MON	Recurring	8.00	0.20
Subtotal:			86.00	0.20
Year 4:	RES	Recurring	78.00	0.00
	MON	Recurring	8.00	0.20
Subtotal:			86.00	0.20
Total:			442.80	0.80

(Optional) Alternative Actions/Solutions and Impacts

A "No Action" alternative will not allow quantified evaluation in changes of the park's air and visibility values.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.6

Project Statement

HOSP-N-010.001

Last Update: 03/14/95
Initial Proposal: 1994

Priority: 6

Title : RESOURCE BASIC INVENTORY
Sub-title: INITIAL RESOURCE DATABASE

Funding Status: Funded: 0.00 Unfunded: 57.50

Service-wide Issues : N20 (BASELINE DATA)

Cultural Resource Type:

N-RMAP Program codes : V00 (Vegetation Management)
 V01 (Native Terrestrial Plant Management
 and Monitoring)

10-238 Package Number :

Problem Statement

Significant research has been undertaken in recent years at the park. Within the last ten years, inventories have been completed on ferns, hepaticas, small mammals, bats, the flora of the Grand Promenade, vascular plants in the tufa area, and algae associated with the park thermal springs. In addition investigators have completed an aquatic survey of Ricks Pond and Gulpha Creek, and an investigation of radon and lead radioactivity associated with the thermal waters.

Additional studies must be completed in order to provide sufficient baseline data so the park can make valid management decisions. Areas in which the park is still lacking RBI data include the following 1) a survey of vascular plants (detailed in project number 7) 2) an inventory of reptiles and amphibians found in the park 3) a breeding bird survey and updated bird checklist 4) an inventory of the insects of the park with special consideration to species that utilize, and may be dependent on the thermal springs 5) a stream biotic survey that would include, fish, mollusks and other aquatic invertebrates. Additional areas may become apparent as the Service implements its system-wide Inventorying and Monitoring program.

Future environmental assessments will depend on a comprehensive, accurate inventory of major biotic communities along with habitat and location data.

Description of Recommended Project or Activity

Continue contacts with the Nature Conservancy, the Arkansas Natural Heritage Commission and local individuals and researchers interested in the resources of Arkansas. As funding becomes available begin the most urgently needed studies. Although this park has not been selected as a prototype park for the service-wide I&M program implementation, continue to seek regional assistance in accomplishment of this goal.

BUDGET AND FTEs:

-----FUNDED-----					
Source	Activity	Fund Type	Budget (\$1000s)	FTEs	
			=====		
Total:			0.00	0.00	
-----UNFUNDED-----					
	Activity	Fund Type	Budget (\$1000s)	FTEs	
Year 1:	RES	Recurring	16.00	0.30	
	MON	Recurring	4.50	0.10	
	Subtotal:		20.50	0.40	
Year 2:	RES	Recurring	16.00	0.30	
	MON	Recurring	4.50	0.10	
	Subtotal:		20.50	0.40	
Year 3:	RES	Recurring	7.50	0.20	
	MON	Recurring	4.50	0.10	
	Subtotal:		12.00	0.30	
Year 4:	ADM	Recurring	4.50	0.10	
			=====		
Total:			57.50	1.20	

(Optional) Alternative Actions/Solutions and Impacts

A "No Action" alternative would not enable the park to identify existing resources that need protection.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.6

Project Statement
Last Update: 03/15/95
Initial Proposal: 1994

HOSP-N-015.001
Priority: 12

Title : REHABILITATION OF HOSP MOUNTAIN PICNIC AREA
Sub-title: FOREST RESTORATION

Funding Status: Funded: 4.00 Unfunded: 15.00

Servicewide Issues : N06 (LAND USE PRAC)
N22 (VIS USE-DEV ZN)

Cultural Resource Type:

N-RMAP Program codes : D00 (Disturbed Area Rehabilitation)

10-238 Package Number :

Problem Statement

Hot Springs Mountain picnic area is located in a small stand of even aged old growth Short Leaf Pine trees. The trees are stressed from age, soil compaction and recent construction activities. The area is very susceptible to southern pine beetle attack. In 1989 three pine trees on the edge of the picnic area were killed by Southern Pine beetles and removed.

There is a good probability that the majority of the pine trees will begin to die within a short span of time. The park would like to investigate suitable methods to loosen the compact soil and promote the health of the present stand of trees; eventually the even-aged pines will have to be replaced with a designed picnic area planting scheme.

Description of Recommended Project or Activity

Present activities are limited to area clean-up, and inspection and removal of hazardous limbs and trees.

BUDGET AND FTEs:

		-----FUNDED-----			
	Source	Activity	Fund Type	Budget (\$1000s)	FTEs
1994:	PKBASE-OT MIT		One-time	4.00	0.20

		=====		
Total:		4.00	0.20	
-----UNFUNDED-----				
	Activity	Fund Type	Budget (\$1000s)	FTEs
Year 2:	MIT	One-time	15.00	0.30
		=====		
Total:		15.00	0.30	

(Optional) Alternative Actions/Solutions and Impacts

A "No Action" alternative will result in a crisis activity to remove all the trees because they constitute a safety hazard to picnicking visitors.

Compliance codes : EXCL (CATEGORICAL EXCLUSION)

Explanation: 516 DM2 APP. 2, 1.7

TABLES

CULTURAL RESOURCES DOCUMENTATION CHECKLIST

TITLE	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
PLANNING DOCUMENTS			
Preauthorization and Authorization			
Statement for Management (SFM)		X	
Outline of Planning Requirements (OPR)		X	
General Management Plan (GMP)		X	
Development Concept Plan (DCP)		X	
Resources Management Plan (RMP)		X	
Interpretive Prospectus (IP)		X	
SERVICEWIDE INVENTORIES, LISTS, CATALOGS AND REGISTERS			
Cultural Resources Management Bibliography (CRBIB)		X	
Cultural Sites Inventory (CSI)			X
List of Classified Structures (LCS)		X	
National Catalog of Museum Objects		X	
Cultural Landscapes Inventory (CLI)		X	
National Register of Historic Places		X	
BASIC CULTURAL RESOURCE DOCS.			
Archeological Overview and Assessment			X
Archeological Identification Studies			
Archeological Evaluation Studies			
Rapid Ethnographic Assessment Procedures (REAP)			
Cultural Affiliation Study			
Ethnographic Landscape Study			
Ethnographic Overview & Assessment			
Ethnographic Oral & Life Histories			

TITLE	CURRENT AND APPROVED	INCOMPLETE; NEEDS REVISION OR UPDATING	NEEDED
Ethnographic Program			
Historic Resource Study			X
Historic Base Map			X
Park Administrative History			X
Scope of Collection Statement	X		
SPECIAL RESOURCE STUDIES AND PLANS			
Archeological & Ethno. Collections Studies			
Archeological Data Recovery Studies			
Collection Management Plan	X		
Collection Storage Plan		X	
Collection Condition Survey			X
Cultural Landscape Report (CLR)			X
Ethnohistory			
Exhibit Plan	X		
Historic Furnishing Report	X*		
Historic Structure Report (HSR)	X		
Inventory & Condition Assessment Program (ICAP)			X
Social Impact Study			
Special History Study			
Traditional Use Study			

*On file for Fordyce Bathhouse only.

SUMMARY CHART FOR ARCHEOLOGICAL SITES

Significance	Condition					Impacts				Documentation		
	Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National												
State & Regional												
Local												
Not Evaluated					16				16			16
Totals					16				16			16

SUMMARY CHART FOR STRUCTURES

Significance	Condition					Impacts				Documentation		
	Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National	5	3	1			1	2	5	1	8	1	
State & Regional												
Local												
Not Evaluated	4	2	4	1	56	1	3	4	59	8	0	59
Totals	9	5	5	1	56	2	5	9	60	16	1	59

SUMMARY CHART FOR OBJECTS

DOCUMENTATION Form 10-254 Submitted to National Catalog at Harpers Ferry	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology	TOTALS
Registration Data Only								
Registration & Catalog Data	409	0	13,627	206,388	3,642	7	195	224,268
Total Items Catalogued	409	0	13,627	206,388	3,642	7	195	224,268
Backlog to be Catalogued	(302)	0	(24,978)	(164,692)	(27)	0	0	(190,000)
Total Collection Summary	(711)	0	(38,605)	(371,080)	(3,669)	7	195	(414,268)

CONDITION The percentage of collection in the following categories:	Archeology	Ethnology	History	Archives	Biology	Paleontology	Geology
Excellent	19.5	0	3	2	4	71	1
Good	20.0	0	21	27	83	29	80
Fair	19.5	0	11	26	11	0	16
Poor	5.0	0	1	1	1	0	3
Unknown	36.0	0	64	44	1	0	0

SUMMARY CHART FOR CULTURAL LANDSCAPES

Significance		Condition					Impacts				Documentation		
		Good	Fair	Poor	Destroyed	Unknown	Severe	Moderate	Low	Unknown	Good	Fair	Poor
National	1		1				1				1		
State & Regional													
Local													
Not Evaluated	9					9				9			9
Totals	10	0	1	0	0	9	1	0	0	9	1	0	9

SUMMARY CHART FOR ETHNOGRAPHIC RESOURCES

Resource Types	National Register	Authority	Non-Recreational Use	Documentation Level
Sites	0	NA	0	NA
Structures	0	NA	0	NA
Objects	0	NA	0	NA
Natural Resources	0	NA	0	NA
Ethnographic Landscapes	0	NA	0	NA
Other	0	NA	0	NA

BIBLIOGRAPHY OF REFERENCES CITED

BAKER, CHARLES MICHAEL

- 1975 Archeological Inventory of Hot Springs National Park. Report prepared for the National Park Service, Southwest Region, by the Arkansas Archeological Survey and University of Arkansas Museum, Fayetteville.

BELL, ALONZO

- 1882 Report on the Hot Springs of Arkansas to the Secretary of the Interior, Washington D.C., U.S. Government Printing Office.

CRON, FREDERICK W.

- 1946 The Hot Springs of the Ouachita. Unpublished ms. on file in the library of Hot Springs National Park.

CROMWELL, NEYLAND, TRUEMPER, MILLETT & GATCHELL, INC.

- 1973 Historic Structures Report, Hot Springs National Park, Little Rock, Arkansas.

FEATHERSTONHAUGH, G.W.

- 1844 Excursion Through the Slave States. John Murray, London.

HARRISON, LAURA SOULLIERE

- 1986 Architecture in the Parks: National Historic Landmark Theme Study. U.S. Department of the Interior, National Park Service.
- 1991 Water, Water Everywhere: A Brief Investigation of Deterioration in the Superior, Hale, Maurice, Ouapaw, and Ozark Bathhouses. Hot Springs National Park, Hot Springs, Arkansas.

HOT SPRINGS RESERVATION

- 1878- Reports of the Superintendent of Hot Springs Reservation to the
1921 Secretary of the Interior. Hot Springs National Park museum collections.

McDERMOTT, JOHN F.

- 1963 Western Journal of Dr. Geo. Hunter: Excursion up the Ouachita 1804-1805. Trans. Am. Philosophical Society, Philadelphia, Pennsylvania.

MUSICK, THOMAS H.

- 1890 Investigation of Hot Springs Affairs, Report to the Secretary of the Interior. Government Printing Office, Washington, D.C.

NATIONAL PARK SERVICE, U.S. DEPARTMENT OF THE INTERIOR

- 1922- Reports of the Superintendent of Hot Springs National Park to the
1966 Secretary of the Interior. Hot Springs National Park museum collections.

- 1977 Statement for Management, Hot Springs National Park, Hot Springs National Park
Resources Management Plan for Hot Springs National Park, Hot Springs National Park
- 1981 Resources Management Plan for Hot Springs National Park, Hot Springs National Park
- 1985 Bathhouse Row Adaptive Use Program, The Bathhouse Row Landscape: Technical Report 1
Bathhouse Row Adaptive Use Program, The Superior Bathhouse: Technical Report 2.
Bathhouse Row Adaptive Use Program, The Hale Bathhouse: Technical Report 3.
Bathhouse Row Adaptive Use Program, The Maurice Bathhouse: Technical Report 4.
Bathhouse Row Adaptive Use Program, The Fordyce Bathhouse: Technical Report 5.
Bathhouse Row Adaptive Use Program, The Quapaw Bathhouse: Technical Report 6.
Bathhouse Row Adaptive Use Program, The Ozark Bathhouse: Technical Report 7.
- 1986 General Management Plan, Development Concept Plan, Hot Springs National Park, Hot Springs National Park
- 1996 Revision of the National Park Service's Thematic Framework Collections Management Report, Hot Springs National Park.

OLMSTED ASSOCIATES ARCHIVES

- 1892- Correspondence concerning Job #1244 for Hot Springs Reservation.
- 1893 Library of Congress, "The Records of the Olmsted Associates," microfilm reel #59, container B80-B82.

PAIGE, JOHN C. AND LAURA SOULLIERE HARRISON

- 1988 Out of the Vapors: A Social and Architectural History of Bathhouse Row. U.S. Department of the Interior, National Park Service.

PETRAVAGE, CAROL A.

- 1987 Historic Furnishings Report: The Fordyce Bathhouse, Hot Springs National Park, Arkansas. U.S. Department of the Interior, National Park Service, Harpers Ferry Center, West Virginia.

ROBISON, HENRY W., AND THOMAS M. BUCHANAN

- 1988 Fishes of Arkansas. University of Arkansas Press, Fayetteville, Arkansas.

SABO, GEORGE III, ANN M. EARLY, JEROME C. ROSE, BARBARA A. BURNETT,
LOUIS VOGELE, JR., AND JAMES P. HARCOURT

- 1988 Human Adaptation in the Ozark-Ouachita Mountains. Arkansas
Archeological Survey, Fayetteville.

SCHAMBACH, FRANK F.

- 1970 Pre-Caddoan Cultures in the Trans-Mississippi South: A Beginning
Sequence. Ph.D. dissertation, Department of Anthropology, Harvard
University, Cambridge.

SCULLY, FRANCIS J.

- 1966 Hot Springs, Arkansas, and Hot Springs National Park. Pioneer Press, Little
Rock, Arkansas.

STEVENS, ROBERT S.

- 1893- Reports to the Secretary of the Interior on Improvements at Hot Springs
1895 Reservation. Hot Springs National Park museum collection.

U.S. DEPARTMENT OF THE INTERIOR

- 1850 Report of the Secretary of the Interior in Answer to a Resolution of the
Senate Relative to the Hot Springs of Arkansas, Ex. Doc. No. 70.
- 1979 The Waters of Hot Springs National Park - Their Nature and Origin. U.S.
Geological Survey Professional Paper 1044-C.

U.S. HOUSE OF REPRESENTATIVES

- 1884 Testimony Taken before the Committee on Expenditures in the Interior
Department, Relative to Certain Things Connected with the Government
Property at Hot Springs, Ark., MIS.DOC No. 58, House of
Representatives.

YOUNG, GLORIA A. AND MICHAEL P. HOFFMAN.

- 1993 The Expedition of Hernando de Soto West of the Mississippi, 1541-1543.
University of Arkansas Press, Fayetteville.

**CULTURAL RESOURCES BIBLIOGRAPHY (CRBIB)
HOT SPRINGS NATIONAL PARK**

- Baker, Charles M. *Archeological Inventory, Hot Springs National Park*. 12/1975. pp. 24. HOLD: SWRO
- Barkmann, Herman G.; Moss, Richard. *Environmental Stabilization and Mothballing, Lamar Bathhouse Report*. 1986. pp. 6. HOLD: SWRO
- Benson, Forrest M.; Libbey, Donald S. *History of Hot Springs National Park*. 1955. pp. 54. HOLD: HFC
- Bookhout, Leland T. *The Hale Bathhouse, Central Avenue, Bathhouse Row National Historic District*. 05/1986. pp. 95. HOLD: WASO
- Bookhout, Leland T. *The Maurice Bathhouse, Central Avenue, Bathhouse Row National Historic District, Hot Spring National Park*. 05/1986. pp. 100. HOLD: WASO
- Bookhout, Leland T. *The Ozark Bathhouse Central Avenue: Bathhouse Row National Historic District, Hot Springs National Park*. 05/1986. pp. 96. HOLD: WASO
- Bookhout, Leland T. *The Quapaw Bathhouse, Central Avenue, Bathhouse Row National Historic District, Hot Springs National Park*. 05/1986. pp. 102. HOLD: WASO
- Bookhout, Leland T. *The Superior Bathhouse, Central Avenue, Bathhouse Row National Historic District, Hot Springs National Park*. 05/1986. pp. 96. HOLD: WASO
- Copeland, Randall; Stiles, Wilson. *Historic Structure Report, Fordyce Bathhouse, Hot Springs National Park*. pp. 431. HOLD: WASO
- Cromwell, Neyland, Truemper, Millett & Gatchell, Inc. *Historic Structures Report, Hot Springs National Park*. 11/1973. pp. 200. HOLD: WASO
- Einert, Alfred Erwin. *Magnolia Tree and Landscape Assessment for Bathhouse Row, Hot Springs National Park, Arkansas*. 03/1994. pp. 8. HOLD: WASO
- Greenfield, Judy. *Curatorial Storage at the Fordyce Bathhouse*. 1992. pp. 11. HOLD: HFC
- Greenfield, Judy. *Guidelines for Furnishings Maintenance and Protection, Fordyce Bathhouse*. 1992. pp. 49. HOLD: HFC

Greenfield, Judy. *Maintenance Situations Requiring Attention and Conservation/ Restoration Concerns for Specific Artifacts, Fordyce Bathhouse*. 1992. pp. 4. HOLD: HFC

Harrison, Laura Soulliere. *Turning the Corner: The Landscape History of the Administration Building, Hot Springs National Park*. 01/1990. pp. 45. HOLD: WASO

Kemper, E. C. *Dunbar and Hunter Expedition (1804)*. 07/1936. pp. 4. HOLD: HFC

Maeder, Richard H. *Steeped in Hot Water: The Establishment and History of Hot Springs National Park*. pp. 15. HOLD: HFC

Paige, John C.; Harrison, Laura Soulliere. *Out of the Vapors: A Social and Architectural History of Bathhouse Row, Hot Springs National Park*. 1987. pp. 313. HOLD: HFC

Pardue, Diana R. *Collection Preservation Guide, Hot Springs National Park*. 04/1980. pp. 66. HOLD: WASO

Petravage, Carol A. *Historic Furnishings Report, The Fordyce Bathhouse, Hot Springs National Park*. 09/1987. pp. 576. HOLD: WASO

Pitts and Associates Engineers. *Engineering Study of the Quapaw Bathhouse, Phase III, Hot Springs National Park*. 03/1984. pp. 65. HOLD: WASO

Pitts and Associates Engineers. *Investigative Study of Five Bathhouses, Phase II, Hot Springs National Park*. 02/1984. pp. 250. HOLD: WASO

Schreffler, Robert. *General Management Plan, Development Concept Plan, Environmental Assessment, Hot Springs National Park*. 1985. pp. 96. HOLD: HFC

Scott, Jane E. *Overview of Historical Research an Annotated Bibliography and Plans for Future Study*. 06/1978. pp. 9. HOLD: SWRO

Scully, Frances J. *Hot Springs, Arkansas, and Hot Springs National Park: The Story of a City and the Nation's Health Resort*. 1966. pp. 446. HOLD: SWRO

Staff. *Bathhouse Row Adaptive Use Program, the Bathhouse Row Landscape: Technical Report 1, Hot Springs National Park*. 06/1985. pp. 102. HOLD: WASO

Staff. *Bathhouse Row Adaptive Use Program, The Superior Bathhouse: Technical Report 2, Hot Springs National Park*. 06/1985. pp. 28. HOLD: HFC

- Staff. *Bathhouse Row Adaptive Use Program, The Hale Bathhouse: Technical Report 3, Hot Springs National Park*. 06/1985. pp. 35. HOLD: HFC
- Staff. *Bathhouse Row Adaptive Use Program, The Maurice Bathhouse: Technical Report 4, Hot Springs National Park*. 06/1985. pp. 44. HOLD: WASO
- Staff. *Bathhouse Row Adaptive Use Program, The Fordyce Bathhouse: Technical Report 5, Hot Springs National Park*. 06/1985. pp. 44. HOLD: WASO
- Staff. *Bathhouse Row Adaptive Use Program, The Quapaw Bathhouse, Technical Report 6, Hot Springs National Park*. 06/1985. pp. 42. HOLD: WASO
- Staff. *Bathhouse Row Adaptive Use Program, The Ozark Bathhouse, Technical Report 7, Hot Springs National Park*. 06/1985. pp. 35. HOLD: HFC
- Staff. *Bathhouse Row Adaptive Use Program-Technical Report 1 - Landscape*. 07/1985. pp. 102. HOLD: SWRO
- Staff. *Bathhouse Row Adaptive Use Program - Technical Report 2 - Superior Bathhouse*. 07/1985. pp. 28. HOLD: SWRO
- Staff. *Bathhouse Row Adaptive Use Program - Technical Report 3 - Hale Bathhouse*. 07/1985. pp. 35. HOLD: SWRO
- Staff. *Bathhouse Row Adaptive Use Program - Technical Report 4 - Maurice Bathhouse*. 07/1985. pp. 44. HOLD: SWRO
- Staff. *Bathhouse Row Adaptive Use Program - Technical Report 5 - Fordyce Bathhouse*. 07/1985. pp. 44. HOLD: SWRO
- Staff. *Bathhouse Row Adaptive Use Program - Technical Report 6 - Quapaw Bathhouse*. 07/1985. pp. 42. HOLD: SWRO
- Staff. *Bathhouse Row Adaptive Use Program - Technical Report 7 - Ozark Bathhouse*. 07/1985. pp. 35. HOLD: SWRO
- Staff. *General Management Plan, Development Concept Plan, Hot Springs National Park*. 06/1986. pp. 106. HOLD: WASO/SWRO
- Staff. *An Historical Data Section for an Historic Structures Report on the Fordyce Bath House*. pp. 200. HOLD: WASO
- Staff. *Historic Structures Preservation Guide for the Superior Bathhouse*. HOLD: HFC
- Staff. *Historic Structure Preservation Guide for the Ozark Bathhouse, Hot Springs National Park*. 1986. pp. 60. HOLD: WASO

- Staff. *Historic Structure Preservation Guide for the Hale Bathhouse, Hot Springs National Park*. 1986. pp. 60. HOLD: WASO
- Staff. *Historic Structure Preservation Guide for the Quapaw Bathhouse, Hot Springs National Park*. 1986. pp. 60. HOLD: WASO
- Staff. *Historic Structure Preservation Guide for the Fordyce Bathhouse, Volume I, General Instructions*. 10/1992. HOLD: HFC
- Staff. *Interpretive Prospectus*. 1986. pp. 36. HOLD: SWRO
- Staff. *Inventory of Furnishings, Part III - Fordyce Bathhouse*. pp. 37. HOLD: SWRO
- Staff. *Land Protection Plan*. 04/1985. pp. 38. HOLD: SWRO
- Staff. *Proposed Boundary Change*. 12/1983. pp. 12. HOLD: SWRO
- Staff. *Resources Management Plan/Environmental Assessment*. 1981. pp. 58. HOLD: SWRO
- Staff. *Resources Management Plan and Environmental Assessment, 1981, Hot Springs National Park*. 10/1981. pp. 49. HOLD: HFC
- Staff. *Statement for Management*. 01/1976. pp. 58. HOLD: SWRO
- Staff, Denver Service Center. *Historic Structures Preservation Guide, Maurice Bathhouse, Hot Springs NP*. pp. 60. HOLD: WASO
- Walling, Larry; Cowley, Jill; Feierabend, Carey; Johnson, Gary; Rhod. *Landscape Management Plan, Bathhouse Row, Hot Springs National Park*. 09/1989. pp. 140. HOLD: WASO
- Witsell, Evans, and Rasco. *Historic Structures Report, Hale Bathhouse*. 04/ 1990. HOLD: WASO
- Witsell, Evans, and Rasco. *Historic Structure Report, Quapaw Bathhouse*. 04/ 1990. HOLD: WASO
- Witsell, Evans and Rasco. *Historic Structures Report, Maurice Bathhouse, Hot Springs National Park*. 04/1990. HOLD: WASO
- Witsell, Evans and Rasco. *Historic Structure Report, Ozark Bathhouse*. 04/1990. HOLD: WASO
- Witsell, Evans; Rasco, Pa. *Historic Structures Report, Superior Bathhouse*. 04/ 1990. HOLD: WASO

Wright, Robert D.; O'Gwynn, Claude H. *Existing and Historic Bathhouse Row
Landscape Study, Hot Springs National Park, Arkansas*. 09/1987. pp. 15.
HOLD: WASO

NATURAL RESOURCES BIBLIOGRAPHY

1. American Geophysical Union. The Temperatures of Hot Springs and the Sources of their Heat and Water Supply: Papers presented at a joint meeting of the Section of Volcanology and the Section of Geophysical Chemistry, American Geophysical Union, April 18, 1923. The Journal of Geology. 1924; 32(3-6). Note: Reprint which pulls together articles originally published separately.
Includes articles on Lassen National Park, Yellowstone National Park and Hot Springs National Park. The article on Lassen discusses the source of heat (volcanic) and the source of the water. The article on Yellowstone includes tables of air and water temperature. The article on Hot Springs describes the author's general observations and gives some water temperature information. (Described in more detail in another record).
 2. Anderson. A Field Checklist of Trees of HOSP. . no date.
Note: Citation found in "HOSP FLORA/FAUNA dBase".
 3. Arkansas Natural Heritage Commission (ANHC). Sensitive Species Database. The Arkansas Natural Heritage Commission maintains a database of sensitive species listed by county.
 4. Army Corps of Engineers, Vicksburg District. Flood Plain Information Ouachita River Hot Springs Creek - Stokes Creek, Molly Creek - Gulpha Creek City of Hot Springs, Arkansas. : US Army Corps of Engineers; 1974 Jun. 28 p. + 24 plates.
Report on the flooding of the Ouachita River and its tributaries past floods, flood factors, future floods. Maps show flooding areas (lines and shading on black and white aerial photographs at a scale of 1:10,000).
 5. Arndt, R. H.; Stroud, R. B., Institute of Science and Technology, University of Arkansas. Thrust faulting near the Hot Springs, Hot Springs, National Park, Arkansas. . 1953 Feb. 30+ p. + maps.
Note: Bound in a gray folder. An envelope containing maps is clipped to the report.
Contents: Regional Geology; Stratigraphy (Ordovician System, Silurian System, Devonian-Mississippian System); Structure Trends at Hot Springs (Folds, Faults, Joints); Relation of Hot Springs to Structure. 5 maps are attached - 2 geologic maps, structure sections (profile diagrams), a stratigraphy chart, "axial traces of folds", "reconstructed axes of fold project to elevation 600 ft".
 6. Arndt, Robert H.; Kuroda, P. K. Radioactivity of Rivers and Lakes in Parts of Garland and Hot Spring Counties, Arkansas. Economic Geology. 1953 Nov; 48(7): 551-567.
Note: Photocopy.
Report on results of analysis of radioactivity in rivers & lakes in the Hot Springs area. Correlates radon levels to geologic formations over which the water flows.
- Arndt, Robert H.; Stroud, Raymond B. Thrust faulting near the Hot Springs, Hot Springs National Park, Arkansas. Appendix 3 in: Arndt, R. H.; Damon, P. E. Radioactivity of thermal waters and its relationship to the geology

and geochemistry of uranium. : Arkansas University Inst. Sci. and Technology; 1953. 28 p. (Annual Prog. Report to U.S. Atomic Energy Commission).

Note: A citation to this document referred to it as an appendix, but this copy is free-standing.

Stratigraphy, structural trends (folds, faults, joints) and relation of hot springs to structure.

8. Author unknown. Check List of Hot Springs Nat'l Pk. Butterflies. . no date. 3 p.

Note: Photocopy.

List of 60 butterfly species.

9. Author unknown. Endangered Plants and Animals of Hot Springs National Park, AR. . 1980 Oct 21. 3 p.

List of threatened, endangered, rare or depleted plants and animals found, or thought to be found in Hot Springs National Park.

10. Author unknown. Hot Springs National Park Wildflower Calendar. . no date. 7 p.

Note: Printed on green paper.

List of plants with color of flower and blooming months. No date or source information.

11. Author unknown. Lichens Within Hot Springs National Park, Arkansas. 4 p.

"Lichens were collected during 1981 and identified by Dr. Jewel E. Moore, 1982. Verification of certain lichens was done by Dr. Mason E. Hale, 1983.".

12. Author unknown. Trees in Whittington Park. . no date. 3 p.

Note: Stapled pages.

List of tree species with circumference and age. Last two pages are a map showing locations of trees.

13. Baker, James B., Compiler. Ecosystem Management Research in the Ouachita Mountains: Pretreatment Conditions and Preliminary Findings. New Orleans, LA: US Forest Service, Southern Forest Experiment Station; 1994. 259 p.

Note: Softbound with a green cover.

Compilation of papers related to the Ouachita National Forest which covers a large area west and north of Hot Springs, AR. Includes sections on plants, animals, arthropod and microbial communities, water, soils, and cultural resources, scenic quality, logging and management economics.

14. Bazan, Evangelina. Floristic Investigation of the Hepatics Within the Discharge Area of the Hot Springs. . 1981 Jun. 6 p.

Note: Bound in a gray folder.

Author collected liversorts in various areas in the park (voucher specimens were deposited in the Biology Department Herbarium at Texas A&M University). Lists species with notes on habitats.

Bedinger, M. S.; Pearson, F. J.; Reed, J. E.; Sniegocki, R. T.; Stone, C. G. The Waters of Hot Springs National Park, Arkansas-Their origin, Nature, and Management. ; 1974. 102 p. + maps. (Open-file report to the National

Park Service, Southwest Region, Santa Fe, New Mexico).

Note: See also similar published report "The Waters of Hot Springs National Park, Arkansas-Their Nature and Origin".

Table of contents: Geologic Setting; Character of the spring and well waters in the hot-springs area (physical quality - flow, temperature and silica concentration, and chemical quality - hydrogen and oxygen isotopes, carbonates, radioactivity); The Hot-Spring Flow System. Includes tables and graphs of data. In the back pocket is a geological map, a land cover map, and a map showing locations of cold springs and wells.

16. Bedinger, M. S.; Pearson, F. J.; Reed, J. E.; Sniegocki, R. T.; Stone, C. G. The Waters of Hot Springs National Park, Arkansas-Their Nature and Origin. : US Geological Survey; 1979. 32 p. + 1 mpa. (Geohydrology of Geothermal Systems. Geological Survey Professional Paper 1044-C).
Note: See also similar, unpublished report "The Waters of Hot Springs National Park, Arkansas-Their origin, Nature, and Management".
Table of contents: Geologic Setting; Character of the spring and well waters in the hot-springs area (physical quality - flow, temperature and silica concentration, and chemical quality - hydrogen and oxygen isotopes, carbonates, radioactivity); The Hot-Spring Flow System. Includes tables and graphs of data. In the back pocket is a geological map (1:24,000 scale).
17. Bedinger, M. S.; Sniegocki, R. T.; Poole, J. L. The Thermal Springs of Hot Springs National Park, Arkansas--Factors Affecting Their Environment and Management. Little Rock, AR: US Geological Survey, Water Resources Division; 1970 May. 74 p.
Note: "For U.S. Government use only. Not reviewed for conformance with Geological Survey standards and nomenclature". Typewritten report to the National Park Service, SWR, Santa Fe, New Mexico.
Summary of the hydrogeology of the hot springs based upon best current information (as of 1970). Discusses the flow of water from the surface into the ground and out at the hot springs, the nature of the water (minerals, gases, temperature, and radioactivity), the impact of human activities, and management issues (flooding pollution, park development). Includes tables of data gathered from previous reports.
18. Bell, Alonzo, Late Assistant Secretary of the Interior. Report on the Hot Springs of Arkansas. Washington DC; 1882. 27 p. Note: Very fragile. DSC microfilm number 128/60386.
"Description of the Springs, and Geological Features of Hot Springs Mountain as given by early Explorers - Properites of the Hot Waters-Analysis of the waters and tufa-testimony of medical men on their qualities-bathing facilities-hotel accomodations-transportation charges-brief history of title to lands, &c.".
19. Bergfelder, Bill. The Origin of the Thermal Water at Hot Springs, Arkansas. : University of Missouri-Columbia; 1976 Dec. 64 p.
Note: Master's Thesis. One copy has a gray cover, another is bound in a tan folder.
Summarizes information on the geology of the Hot Springs region and theories for the origin of the hot water. Then presents original gravity data and a new theory - that the water begins as rainwater, filters down and is heated by an isolated termal system and rises rapidly to the surface where it mixes with cold water. Concludes that it is not a viable

source of geothermal energy production. Includes a gravity map and a diagram of water circulation.

20. Blum Energy Consultants. Level II Survey of Geothermal Supply and Distribution System Hot Springs National Park Final Report. : National Park Service; 1984 Oct. 40+ p. (Order No. PX 7300-3-0326).
Survey to identify hot water consumption and costs, availability of thermal hot water, program for management. Includes water temperature and gallons per minute data from 1901 and 1976-1984. Appendix A gives monthly water use by each bathhouse October, 1982 to January, 1984.
21. Boltwood, B. B. On the Radioactive Properties of the Waters of the Springs on the Hot Springs Reservation, Hot Springs, Ark. Am. Jour. Sci.. 1905; 20(4th ser.): 128-132.
Note: Citation found in "Geologic Atlas of the United States, Hot Springs Folio".
22. Branner, John C., State Geologist. Annual Report of the Geological Survey of Arkansas for 1891 Volume I: The Mineral Waters of Arkansas. Little Rock, AR: Little Rock Press Printing Company; 1892. 144 p.
Note: The Fordyce library has several copies of this book. The Natural resource library has copies of the pages pertaining to Hot Springs, AR. Chapter II, "The Waters of the Hot Springs" has sections on the origin of the high temperature of the waters, chemistry of selected springs, and analysis of tufa deposits.

Bryan, K. The hot water supply of the Hot Springs, Arkansas. The Journal of Geology. 1922 Aug; 30(6): 425-449.
Note: Reprint.
Discussion of the geology of the area and origin of the water (is it circulated precipitation or is the source underground and finite).
24. Bryan, Kirk. The Temperatures of Hot Springs and the Sources of their Heat and Water Supply, IV the Hot Springs of Arkansas. The Journal of Geology. 1924 Aug; 32(6): 449-459.
Introduction to the geology of the hot springs with graphs showing changes in water temperature and air temperature.
25. Buchanan, Tom M.; Houston, James; Nix, Joe F.; Meyer, Richard L.; Schmitz, Eugene H. A Limnological Study of Ricks Pond and the Gulpha Creek Drainage in Garland County, Arkansas an interdisciplinary study conducted for the National Park Service. : Arkansas Water Resources Research Center, University of Arkansas; 1978 Nov; Publication No 62. 109 p.
Sections on water quality (water temperature, dissolved oxygen, specific conductance, pH, alkalinity, chemistry, coliform, turbidity), phytoplankton & periphyton (includes a list of species and density of organisms), aquatic vegetation (brief description of aquatic plant species), zooplankton (list of species and density of species), benthos (list of species and number of organisms), fishes (list of species with comments and distribution maps) and recommendations for the establishment of a put-and-take fishery in Ricks pond (created by the construction of a dam).
- Chapter 37: Hot Springs National Park. In: Harris, Ann; Tuttle, Esther. Geology of National Parks. 3rd edition ed. Dubuque, Iowa: Kendall/Hunt

Publishing Company; 1983: p. 453-462. 554 p.
Chapter on the geology of Hot Springs National Park. Includes a chart showing rock units and geologic events associated with various time periods and text on the origin of the hot springs, rocks of special interest in the park and geologic history. Illustrated with diagrams.

27. Coury and Associates; Hydro-Triad, Ltd.; Affiliated Engineers, Inc. Preliminary Study: Geothermal Study, Hot Springs National Park, Arkansas. ; 1988; Contract No. CX-2000-8-0009. 151 p. (59 text, 92 appendices).
Note: Bound in a black three-ring binder with spine label "Coury Report".
Copy submitted to the National Park Service, SWRO, Santa Fe, NM.
Report on study to document existing system of hot spring water transportation and use, and recommend improvements. Includes water use data.

28. Crawford, Jane C. Summary of Previous Studies Characterizing the Geology and Flora of the Promenade Area of Hot Springs National Park Prepared for Hot Springs National Park Hot Springs, Arkansas. . 1982 Jun 2. 6 p.
Note: "In partial fulfillment of Purchase Order #25288".
Summarizes 5 reports which are relevant to the proposed project to restore 1 thermal spring to its natural state. (All of the reports are held by the park and described in this database).

29. Cron, Frederick W. Mineral Waters at Hot Springs, Arkansas. The Military Engineer. 1939 Mar.
Note: Photocopy.
Description of the containment of the spring water for human uses.

30. Cron, Frederick W. The Springs. . 1939.
Note: Photocopy.
Typed manuscript. Description of the hot springs with many quotes from historical reports.

31. Dale, Edward E. Jr. Final Report on a Search for Rare or Endangered Species of Vascular Plants of the Tufa Area in Hot Springs National Park Garland County, Arkansas. : Hot Springs National Park; 1981 Oct 1. 37 p.
Note: The copy in the Fordyce Curatorial Storage unit contains the original color photographs.
Description of search for rare or endangered plant species in the tufa area of the park. Found vegetation typical of disturbed areas and no special species. Includes photographs and a checklist of the 244 plant species found (notes that more species would be identified at other times of the year).

32. Dale, Edward E.; Watts, Michael R., University of Arkansas. Vegetation of Hot Springs National Park, Arkansas [FINAL REPORT]. : National Park Service; 1980 Apr 1. 85 p. (Purchase Order CX 70299001).
Describes 4 vegetation types (Upland Hardwood, Pine-Oak Hickory, Oak Hickory-Pine, Mixed Forest) and relation of environmental factors to vegetation types. Appendix I gives the results of a soil analysis (organic matter, pH, phosphorus, nitrogen, potassium, calcium, sodium, magnesium, conductivity). Tables give data on species density, basal area, importance value, percent cover, and the geology & exposure associated with various vegetation types. Refers to a map which is not included with this copy of the document.

Deaderick, William H. Birds of Hot Springs and vicinity. Natural History Journal Hot Springs Natural History Association. 1938; 3: 1-19.

"This list of 208 species and subspecies of birds observed in Hot Springs National Park and vicinity is the result of three years of intensive observation." "Field trips were confined largely to the immediate vicinity of Hot Springs National Park and to the waters and shores of Lake Hamilton". List gives common and scientific name with comments about year and time of observations.

34. Deaderick, William H. A Preliminary List of the Birds of Hot Springs National Park and Vicinity. Wilson Bulletin, L. 1938 Dec: 257-273. Discussion of the park and status of birds followed by an annotated list of species (with comments on season and recorded observations).
35. Deaderick, William H. Some Notes from Arkansas. Auk. 1936 Jul; 53: 349-350.
Photocopy of this page (stapled with other pages from this journal). Describes bird sightings in Arkansas - one in Hot Springs - an orange-crowned warbler.
36. Dellinger, S. C.; Black, J. D. Notes on Arkansas Mammals. Journal of Mammalogy. 1940 May; 21(2): 187-191.
Note: Photocopy.
At the bottom of page 188 is reference to the prairie spotted skunk. "The species apparently reaches its eastern limit, in this state, at Hot Springs where it is reported common".
37. Denver Service Center. Draft Environmental Statement General Management Plan Hot Springs National Park Arkansas. : Denver Service Center; 1976 Aug 10. 225 p.
Includes general descriptions of the natural resources of the park.
38. Denver Service Center. Proposal/Assessment General Management Plan Hot Springs National Park (Bathhouse Row and Vicinity) Arkansas. ; 1977 Oct. 120 p.
Note: Spiral bound with white and green cover.
Plans for the area around bathhouse row. Includes some discussion of natural resources.
39. Denver Service Center. United States Department of the Interior Draft Environmental Statement General Management Plan Hot Springs National Park Arkansas. ; 1976 Aug 10. 225 p.
Environmental Statement relating to the plan to encourage use of the vacated bathhouses. Appendices include general information about the plants, animals and climate of the area.
40. Department of the Interior. Annual and Other Reports Relating to the Hot Springs Reservation Ark., Vol 1-3. ; 1877. 3 volumes (900+ p.).
Note: Hardbound with clay-colored covers.
Compilation of reports - most are administrative and discuss the operation of the baths. Two are reports on the waters of the hot springs (these are described in more detail in a separate record in this database). Some black and white photographs.

41. Einert, Alfred Erwin, Horticulturist and Landscape Architect. Magnolia Tree and Landscape Assessment for Bathhouse Row Hot Springs National Park, Arkansas. : Prepared for the National Park Service; 1984 Mar 15. 10+ p. (NPS Order NO. PX20004D031).
Note: Cover letter attached to front of report.
Assessment of magnolia trees and other landscape plantings along Bathhouse Row. Looked at scars, roots and insect infestations. Made recommendations for improving the health of individual trees and restrictions on construction to prevent damage. Refers to a map which is not included with this copy.
42. Epperson, C. E.; Rhodes, N. R. Characterization of Radioactivity in Hot Springs National Park Arkansas. Little Rock, AR: University of Arkansas for Medical Sciences, College of Pharmacy; 1988. 10+ p.
Note: The cover page reads "Thirty-Third Annual Meeting of the Health Physics Society".
Published abstract (last page), plus report (apparently unpublished). "The objective of this study was to determine the types and measure the levels of radioactive emissions found within the Hot Springs National park boundaries. The study should help determine if the emissions pose a significant health hazard to the public or to park workers." Includes tables of data.
43. Epperson, Claude E. Characterization of Radioactivity in Hot Springs National Park Arkansas. Proceedings of the Arkansas Academy of Science. 1990; 44: 125-127.
Note: Author taken from address on front (an article with an identical name is written by this author as well - see description in this database).
Study to determine the types and measure the levels of radioactive emissions found in Hot Springs National Park.
44. Featherstonhaugh, G. W., US Geologist. Geological Report of an Examination Made in 1834 of the Elevated Country between the Missouri and Red Rivers. ; 1935. p. 61-70.
Note: Photocopy of these pages only. Bound in a blue folder with several other reports. Label on front of folder reads "The Elevated Country (between the Missouri & Red Rivers) Lead Mines of Missouri Geological Reconnaissance of Arkansas".
Description of the geology of the area and of the hot springs by an early observer.
45. Fellowes, Terence Leigh, Southern Methodist University. The Geology of Hot Springs National Park and Vicinity, Central Arkansas; a Non-Technical Discussion. . 1966 Jun. 26 p.
Note: See also the master's thesis with virtually the same title, printed in 1968.
Non-technical description of the geomorphology of the Hot Springs Area. Includes charts and original black & white photographs.
46. Fellowes, Terence Leigh. Geology of Hot Springs National Park and Vicinity, Central Arkansas. : Southern Methodist University; 1968 Sep 30. 82 p.
Note: Master's Thesis. Bound in a black 3-ring binder. See also non-technical version written by the same author in 1966.

Description of the geomorphology of the Hot Springs Area. Includes sections on stratigraphy, crystalline rocks, structure (folding, faulting, dynamic analysis), theories concerning the origin of the thermal springs and a summary of the geologic history. In the back pocket is a geologic map created by the autor.

47. Figure 3. - Geologic map of Hot Springs National Park and vicinity, Arkansas. US Geological Survey. : US Geological Survey; 1973. 1 sheet; 1½' x 2' (approximate); 1:24000.
Note: Folded map. A second copy is tucked in the report "Development Outline Hot Springs National Park", 1951, which is kept on the locked shelves.
Map outlining rock formations and faults. One color.
48. Figure 4. - Land cover in the vicinity of the Hot Springs, Arkansas. US Geological Survey. : US Geological Survey; 1970. 1 sheet; 1½' x 2' (approximate); 1:24000.
Note: Folded map. Regions have been hand colored with colored pencils. No date. Base map date is 1966. A second copy (not colored) is tucked in the report "Development Outline Hot Springs National Park", 1951, which is kept on the locked shelves.
Map showing areas which are forested, deforested, quarry, or urban land cover (with percentage covered by roofs, roads, parking lots...). No indication of the larger work this is part of.
49. Foster, Margaret D. Chemical Character of the Hot Springs of Arkansas and Virginia. Industrial & Engineering Chemistry. 1930 Jun; 22: 632.
Results of chemical analysis of water at Hot Springs (temperature, solids, silica, iron, calcium, magnesium, sodium, potassium, HCO₃, sulfate, chlorine, NO₃ and hardness. Noted some changes from Haywood data compiled in 1901.
50. Garnett, A. S., "a resident physician". A Treatise on the Hot Springs of Arkansas. ; 1874. 44 p.
Article describing the health benefits of the hot spring water with a chapter on geology. Includes a table of spring temperatures reproduced from earlier reports.
51. Glasgow, William Jr. Hot Springs of Arkansas, with their Travertine Formation. St. Louis, MO: L. Gast Bro. and Co.; 1860.
Note: Citation found in "The Waters of Hot Springs National Park, Arkansas-Their Nature and Origin".
52. Gregg, H. R. Arkansas (Hot Springs National Park) plants collected by H. R. Gregg Received from the National Park Service, Dept. of the Interior, (Acc. no. 132500). . 1935. 10 p.
Note: Stapled pages.
"Identified at U. S. National Herbarium, the Pteridophyta by William R. Maxon, Gramineae by J. R. Swallen, Acanthaceae by E. C. Leonard, Compositae (part) by S. F. Blake, the remainder by C. V. Morton, June, 1935." A list of scientific names in no obvious order.

Gregg, H. R. Check List of the Flora of Hot Springs National Park and Vicinity. 30+ p.
Note: Stapled pages. Photocopy.

List of plant species (scientific and common names). Arranged by family.

- . Gregg, H. R. Occurrence of the hoary bat at Hot Springs National Park, Arkansas. J. Mamm.. 1937; 18: 98.
Note: Citation found in "The Bats of Hot Springs National Park, Arkansas".

- 55. Gregg, H. R. Trees of Hot Springs National Park. . 1935. 61 p.
Typed manuscript with original black and white photographs (in original copy kept in the curatorial storage unit). Describes tree species that are found in the park. No specific references to the park itself. Presumably the photos are taken in the park.

- 56. Gregg, H. R. White-throated Swift at Hot Springs National Park, Arkansas. Auk. 1935 Oct; 52: 452.
Photocopy of this page (stapled with other pages from this journal). Describes a white-throated swift found in Hot Springs during a storm.

- 57. Grubbs Consulting Engineers, Inc. Soil and Foundation Investigation Slide Areas West Mountain Hot Springs National Park, Arkansas for National Park Service Washing, D. C. ; 1969 Oct. 13 p.
Note: Bound in reddish-brown folder.
Report on an investigation of a rock slide in the park with recommendations for stabilization and safety precautions in the future.

- 58. Hardy, Alan D. Mortality of Ozark Chinkapin due to the Chestnut Blight Fungus at HOSP. . 1983 May. 20+ p.
Note: Spiral bound with a clear plastic cover.
Report on the status of ozark chinkapin (a tree) in Hot Springs National Park. Most trees are being killed by chestnut blight. This report includes extensive information about the locations of trees in the park (including a map and annotated list of stands).

- 59. Haywood, J. K.; Weed, Walter Harvey. Analyses of the Waters of the Hot Springs of Arkansas and Geological Sketch of Hot Springs Arkansas. Department of the Interior. Annual and Other Reports Relating to the Hot Springs Reservation Ark., Vol 3. ; 1912: midway through the volume. 56 p.

Note: 1 copy hardbound with other documents (clay-colored binding), another bound separately with gray paper. Also published as a US Senate document.
Describes methods of examination for different compounds and water quality measures, medicinal valule of substances usually found in mineral waters. Followed by charts of data for each of the springs. At the end is a separate, brief report on the geology of the area - topography, rocks, hot springs, tufa deposits, sources of water in hot springs, sources of mineral content of waters, constancy of spring temperatures and discharge and source of heat. Includes several historical black and white photographs of the area.

- 60. Haywood, J. K.; Weed, Walter Harvey. The Hot Springs of Arkansas: Report of an Analysis of the Waters of the Hot Springs on the Hot Springs Reservation, Hot Springs, Garland County, Ark. with an account of the methods of analysis emplyed and the medicinal value of various substances usually found in mineral water, and Geological Sketch of Hot Springs,

Arkansas. 57th Cong., 1st sess., S. Doc. 282. ; 1902. 94 p. (Document No. 282).

Note: Also published in volume 3 of "Annual and Other Reports Relating to the Hot Springs Reservation Ark."

Describes methods of examination for different compounds and water quality measures, medicinal value of substances usually found in mineral waters. Followed by charts of data for each of the springs. At the end is a separate, brief report on the geology of the area - topography, rocks, hot springs, tufa deposits, sources of water in hot springs, sources of mineral content of waters, constancy of spring temperatures and discharge and source of heat. Includes several historical black and white photographs of the area.

61. Hazlett, D. C., Junior Geologist, National Park Service. The geology of the vicinity of the Hot Springs National Park, Arkansas. . 1935. 15 p. Description of the geology of the Hot Springs National Park area - topography, drainage, stratigraphy, structural features, sedimentary and igneous rocks, geologic history and economic geology.

62. Holland, Leon H. Radioactivity of the Hot Water in the Hot Springs National Park. . no date. 1 p.

Note: Single sheet.

Table of radon content of several springs and comparison with "Army & Navy Spring Well" with comments about the curative properties of this water for people with rheumatism.

Horn, Keith. Collection Records. . 1990. 6 p.

Note: Two identical lists (one with handwritten additions). In both cases, the first page is a cover letter to Hot Springs National Park Superintendent.

Description of fish specimens taken from Hot Springs. Handwritten notes on second copy includes catalog number. Presumably this collection is housed at the author's university - Northeast Louisiana University.

64. Hot Springs National Park Southern Pine Beetle Management Plan. ; 1987. 16 p.

Description of the southern pine beetle problem in Hot Springs National Park with alternative management strategies and control techniques.

65. Hot Springs National Park. Aerial Photos files. 100+ photographs. Black & white, 9" x 9" aerial photographs - the bulk taken in March, 1974 with a few taken in April, 1973. Scale 1"=1015' (approximate - this is written on one file).

66. Hot Springs National Park. ANCS Natural History Database, Hot Springs National Park.

Includes records for plant and animal specimens held at the park. 900 biology, 189 geology and 6 paleontology records. As of 4/95, all of the plant specimens have been entered, but not all of the insects. Collection includes representatives of 92 plant families, 13 fungi, 21 lepidoptera species, 159 rocks and 30 minerals.

Hot Springs National Park Arkansas Vegetation type map. Roseberry, R. D. : National Park Service; 1937 Oct. 1 map; 1" = 400'.

Note: Fordyce curatorial storage copy is a folded oil Cloth map in two

pieces. There are several reproductions in different media in the park. Accompanying text is found in "The Vegetation Type Survey of Hot Springs National park" (described in this database).

Vegetation map indicating 5 vegetation types with different colors: grass, cultivated, woodland-grass, woodland, and pine. These colored areas are further delineated and marked with symbols standing for various plant species (32 species).

68. Hot Springs National Park. Basic Data Hot Springs National Recreation Park. . 1968. 33 p.
Note: Bound in a brown file folder.
Summary of information on topography/physical features, vegetation types, animals, water resources, geology, climate, history and visitation.
69. Hot Springs National Park. Check-List of Birds of Hot Springs National park. National Park Service. Check-List of the Birds of the National Parks. ; 1937 Dec.
"Most of the information contained in this list was furnished by Acting Park Naturalist H. W. Lix". List includes common and scientific names with brief comments, name of observer, and date of observation.
70. Hot Springs National Park. File: 1983 Hazardous Tree Inventory.
File with documents relating to the identification of trees in the park which pose a potential hazard to visitors.
71. Hot Springs National Park. File: Aerial Photo Index. 20+ photographs.
Color, 9" x 9" aerial photographs taken April 11, 1983. File also includes topographic maps with hand-drawn lines showing location of photos.
72. Hot Springs National Park. File: A.N.H.C. - Shortleaf Pine. . 1983. 10+ p.
Folder containing information relating to a shortleaf pine stand which is one of the "oldest, highest quality shortleaf pine (*Pinus echinate*) stands left in the state".
73. Hot Springs National Park. File: Asian Clams.
Various documents related to the asian clam. Some specific to Hot Springs.
74. Hot Springs National Park. File: Bald Eagles.
Notes and correspondence related to bald eagles and their presence or lack thereof in the park.
75. Hot Springs National Park. File: Exotic/Feral Animals.
Includes lists of exotic plant species in the park.
76. Hot Springs National Park. File: Fish.
Handwritten items and photocopies with references to fish in the Hot Springs area.
77. Hot Springs National Park. File: Fire Weather Data Sheets.
3 original fire weather data sheets (relative humidity, air temperature, wind). See also more complete sets of data elsewhere.
- .. Hot Springs National Park. File: Insects.
File with various memos and notes relating to insects in the park. (The

more substantial items have been described individually in this database).

79. Hot Springs National Park. File: Mammals.
Includes checklists of mammals, amphibians and reptiles with no information about their source.
80. Hot Springs National Park. File: Miscellaneous.
Photocopies of excerpts from various documents. Some tables of date on the thermal waters. Several historical descriptions.
81. Hot Springs National Park. File: N4125 Affirms.
Completed data sheets for fire danger. Includes wind, air temperature, precipitation and humidity.
82. Hot Springs National Park. File: Prescribe Burn.
Handwritten notes and original aerial photographs of a prescribed burn in the park.
83. Hot Springs National Park. File: Southern Pine Beetle Infestation.
Various documents related to the southern pine beetle, some notes, correspondence and photos specific to Hot Springs National Park.
84. Hot Springs National Park. File: Trelease's Blue Green Algae.
File with correspondence related to algae in the park.

Hot Springs National Park. Fire Management Plan Hot Springs National Park.
. no date. 75+ p.

Note: Kept in reddish-brown, 3-ring binder.

Fire management plan - policies, fire history, presuppression, suppression, aircraft use, fire safety, rehabilitation & monitoring, prescribed burning.

86. Hot Springs National Park. Fire Manual Hot Springs National Park Hot Springs National Park, Arkansas. . 1961 Jan. 121 p.
Note: Hardbound with a red cover.
Discussion of fire fighting techniques and the management setup for fire fighting in the park. Lots of information, most of a general nature.

87. Hot Springs National Park. Fire Management Plan Hot Springs National Park.
. 1988. 40+ p.

Note: Loose pages held together with a clip.

Fire management plan - fire history, vegetation, fire mobilization, prescribed fire, public relations. Appendices include prescribed fire decision chart, prescribed fire burn plan format, and a fire management units map.

88. Hot Springs National Park. Fire Weather Records. . 1964. 500+ p.
Note: Kept in a clip-board type of binder.
Data sheets and graphs giving information on air temperature, relative humidity, wind and precipitation.

Hot Springs National Park. General Management Plan Amendment Development Concept Plan Environmental Assessment Hot Springs National Park Garland County, Arkansas Team Review Draft. ; 1984 Nov. 100+ p.

Note: Unbound.

Several draft editions. From the November, 1985 draft "Enhance the management of natural resources, the availability of recreational opportunities, and the quality of the visitor experience in the mountain lands area of the park by improving vegetation management, such as vista clearing and restoration of disturbed areas; by rehabilitating existing roads, overlooks, trails, picnic areas, and the Gulpha Gorge campground; by improving visitor orientation and interpretation; and by developing trailhead parking and trails that can be used for day hikes and as connectors to longer trails outside the boundary. Ensure the preservation of thermal springs by establishing a monitoring program for the entire recharge zone...".

90. Hot Springs National Park. General Management Plan Development Concept Plan Hot Springs National Park Garland County, Arkansas. ; 1986 Jun. 106 p.
Summary for natural resource management reads "Ensure the preservation of the thermal springs by determining the extent of the recharge zone, by establishing a monitoring program for the recharge area, by implementing protection measures on properties in the recharge zone within the park boundary, and by working with the city of Hot Springs and Garland County to encourage compatible uses in areas of the recharge zone that are outside the park boundary. Enhance the management of natural resources in the mountain lands area of the park by improving vegetation management and restoring disturbed areas. Initiate additional research necessary to provide for the proper management, interpretation, and protection of natural resources.".
91. Hot Springs National Park. Hazardous Tree Management Plan. 8 p.
Note: Title is handwritten.
Plan to identify and remove trees which may pose a hazard to visitors.
92. Hot Springs National Park. Historical Monthly Weather Records prior to 1950. . 1932. 500+ p.
Note: Kept in a 3-ring binder with title on the spine.
Original data sheets with information about temperature and precipitation.
93. Hot Springs National Park. HOSP FLORA/FAUNA dBase. . 1987 Nov 25. 100+ p.
Note: Pages held together with a clip.
Printout of a 19 database which contain species list compiled from various sources. The databases are: algae and allies, amphibians, birds, bryophytes, crustaceans/mollusks, ferns and allies, fish, forbs (A-M), forbs (N-Z), grasses, Insects, Lichen, Mammals, Plankton, Reptiles, Sedges and Rushes, Shrubs, Trees, and Vines. List of sources is attached.
94. Hot Springs National Park. Hot Springs National Park Listing of Comments on the Weather from the Superintendent's Monthly and Annual Reports. . 1894.
Large computer printout of weather-related excerpts from superintendents' reports.
- .. Hot Springs National Park. Hot Springs National Park Fire History and Summary 1908 to present. . 1980. 1000+ p.

Note: Continuous computer paper bound with a red cover. (11" x 17" approximate).

Various tables of information related to fires in the park.

96. Hot Springs National Park. Hot Springs National Park Thermal Biotic Plan. . 1990 Aug.
Draft document. Table of contents lists 5 sections: purpose, present knowledge and status (algae, ostracods, vegetation), management of the cascade area, long term resource management, areas of needed research.
97. Hot Springs National Park. Land Protection Plan Hot Springs National Park. : National Park Service; 1985 Apr. 75+ p.
Land protection plan for the park. Describes land use (compatible and incompatible with the goals of the park), protection alternatives (zoning, acquisition...) and recommendations. Includes land status maps and a Natural Resources map (shows thermal water discharge zone, recharge zone, flood plain and park boundary). A boundary map is tucked in the back pocket.
98. Hot Springs National Park. Major Provisions of Federal Statues Relating Specifically to Hot Springs National Park. 3 p.
Note: Stapled pages.
List of citations to statues relating to land and wter rights in the park.
99. Hot Springs National Park. Nature Notes. : National Park Service; 1934. several volumes.
Note: The Fordyce library has several copies along with an index for the years 1934-1936 (bound separately and together with other parks). The resource management library has photocopies of the entire collection - bound in a light blue folder with no spine cover).
Bound copies of a bulletin produced by the park. Excellent index. Covers plants, animals and geology.
100. Hot Springs National Park. Proposed Boundary Change Hot Springs National Park Arkansas. : National Park Service; 1983 Dec; 12 p.
Description of new area to be included in the park. A map in the back pocket shows this area.
101. Hot Springs National Park. Radio Nature Broadcasts. . 1934. 400+ sheets.

Transcripts of radio show talks given by park rangers describing flora, fauna, geology, history and other features of the park.
102. Hot Springs National Park. Resources Management Plan for Hot Springs National Park Garland County, Arkansas. ; 1977. 97 p.
Note: Sprial bound with blue cover.
Natural resource projects: continue study of the geology of the hot springs; inventory vegetation, invertebrates, vertebartes, soils, fungi and bacteria decomposers; effect on hot springs of pumping water from cold water well (it appears there may be an association between the two); determine feasibility of using geothermal heating on more buidings; drill holes to determine the stratigraphy and deep geology of the area; study of biology, chemistry, geography and physical features of the Gulpha Gorge watershed (part of the park); unless further information shows the

importance of shortleaf pine-hardwood forest, allow the current forest succession to continue (despite the fact that it is based on unnatural suppression of fire); assess feasibility of reintroducing white-tailed deer and stocking ponds with fish; investigation of tufa (mineral produced by precipitation from spring water); determine impact of cutting into rock at the edge of the park boundaries (for construction); map extent of Tripoli Member of Novaculite - a rock formation which is an unstable base for trails and roads; ecosystem analysis; plan for vegetation on the bathhouse row area; renovate thermal water collection to meet health standards; monitor drinking water for quality; treat cold water, and possible hot water springs with ultraviolet light to kill bacteria; monitor water quality throughout the park (for bathing and consumptive use); eliminate property easements which negatively impact the park; suppress all fires (with possible prescribed burn experimentation); maintain fire fighting capabilities; map abandoned roads which could be used for fire access; develop recreational trails; restore damaged natural areas; address problems associated with overuse of picnic areas; preserve area used as city watershed in a natural state; repair human damage which may lead to erosion; control specified exotic plants; monitor the rare blue-green algae *Phormidium treleasei*; control problems insects & diseases; control feral animals (dogs and cats); control pigeons, rats, mice, mosquitos, chiggers, and fire ants in high visitor use areas; remove venomous snakes when they threaten visitors; educate to prevent hunting; continue maintaining the current campground though it is cramped and too close to a busy road, until it can be phased out or moved; enforce laws to prevent theft of novaculite (used for whetstones); cooperate with local flood control efforts; conduct boundary surveys; educate to prevent use of herbicides and pesticides in park areas; discourage burning for agriculture near the park; monitor livestock trespass problems; cooperate with efforts to determine air pollution problems and address them.

103. Hot Springs National Park. Resources Management Plan and Environmental Assessment, 1981 Hot Springs National Park. ; 1981. 49 p.

Note: Bound in a tan folder.

Natural resource management sections includes 5 project statements: Wildland Fire Management (improving fire suppression capabilities); Thermal Springs Source Identification (where the recharge zone is and what path the water takes before reaching the surface); Exotic Plant Control and Replacement (set up a program to control exotic plants which are negatively impacting the park); Boundary Survey and Monumentization (clarify boundary to avoid disputes over property); Aquatic Resources (map aquatic vertebrates, invertebrates and vascular plants, measure water quality).

104. Hot Springs National Park. Sensitive Species Information Based on USFS Ouchita NF study PLANTS. . 1990 Feb. 30+ p.

Note: Bound in a black 3-ring binder.

List of sensitive species in the Ouchita forest and copies of published information about these species. Species with high potential to be found in Hot Springs National Park are highlighted (none had actually been found in the park when this was compiled).

5. Hot Springs National Park. Southern Pine Beetle Management Plan Hot Springs National Park FY 1986. . 1986.

Description of southern pine beetle infestations, control techniques and

plan for action.

106. Hot Springs National Park. SPB Data. . no date. 75+ p.
 Note: Kept in black, 3-ring binder.
 Data on southern pine beetle outbreaks in Hot Springs National Park.
107. Hot Springs National Park. Untitled: Observation cards.
 Note: Kept in a two-drawer metal index file box.
 Observation cards for animals, plants and geology in the park.
108. Hot Springs National Park. Untitled: Permanent Spring Files. F i l e
 drawer full of files - one for each spring with copies of information
 about that particular spring (water quality measurements, location etc.).
109. Hot Springs National Park. Untitled: cave files.
 Files with notes on the 3 caves found in the park.
110. Hot Springs National Park. Untitled: Herbarium records. . 1934. 400+
 sheets.
 Herbarium records for a collection that no longer exists. Each sheet gives
 the name of the plant, locality, altitude, habitat, remarks and collector
 (H.R. Gregg, park ranger). Handwritten in pencil. Also in the archives is
 the field note book which these records were based on.
111. Hot Springs National Park. Untitled: Trails of Hot Springs National Park.
 . 1989. 300+ p.
 Note: Bound in a large, black 3-ring binder with no title on the spine.
 Front contains lists of trails, social trails, sidewalks, roads, fire
 roads, gates, city streets, trails signs, boundary changes. Followed by
 detailed information for each trail: maintenance level, length, features
 and a map.
112. Hot Springs National Park. Water Resources Management Plan for Hot Springs
 National Park. . 1982. 8 p.
 Brief report with sections on physical description of water resources,
 management of water resources and legal aspects, water resources problem
 identification (dam, septic tank, sewer line, flooding), recommended
 strategies for water resources protection.
113. Hot Springs National Park. Wildlife reports. . 1948-1961.
 Copies of park documents which refer to mammals in the park.
114. Huntzinger, David H. Arthropods Collected in and near Hot Springs National
 Park, Arkansas. . 1962 Aug 24. 14 p.
 Note: Photocopy.
 List of species (scientific names only).
115. Jaquess, Jeffrey Charles. Mineralogy of Modern Mineral Deposits in Hot
 Water Pipes at Hot Springs, Arkansas. : University of Missouri - Rolla;
 1989. 137 p.
 Note: Master's Thesis for a degree in Geology and Geophysics. Bound in a
 black, 3-ring binder.
 Analysis of the mineral deposits which have built up in pipes leading from
 the hot springs to the baths. Major sections in this work are titled:
 Geological Setting; Carbonate Geochemistry; Field Studies; Petrography;

Ore Microscopy; Cathodoluminescence Study; Microprobe Study; SEM Studies. Includes original color photographs (macro- and microscopic). On p. 112 are a few remarks on preventing build-up in the future.

117. Johnson, Forrest L.; Schnell, Gary D., Oklahoma Biological Survey, University of Oklahoma. Wildland Fire History and the Effects on Vegetative communities at Hot Springs National Park, Arkansas [FINAL REPORT]. : Typewritten report to the National Park Service; 1985. 49 p. (Contract #CX-702930034).
Note: One of natural resource copies is kept in a black 3-ring binder. Measured fire fuel load (chose sampling sites and weighed flammable material). Estimated natural fire frequency by reviewing fire suppression records and examining fire scars. Compared burned areas with adjacent unburned areas to determine rates of recovery from fire for various vegetation types and plant species. Recommends prescribed burning and monitoring. Maps show study sites.
118. Kenney, Frank, Hot Springs National Park Resource Management Technician. Endangered Plants and Animals of Hot Springs National Park, AR. . no date. 3 p.
Note: Stapled pages.
List of endangered, threatened, rare and depleted species of plants and animals which may occur in the park.
119. Knox, Ruth; Knox, Bob. Flowers Hot Springs National Park. . 1988 Mar. 200+ p.
Note: Kept in a tan 3-ring binder. On the back of the first page is a note "Lovingly gathered for the Hot Springs National Park Service. Ruth & Bob Knox Hot Springs Village March 1988". On the library card is a note "This collection can only be used in the library."
Plant specimens with drawings, photographs and descriptive text (taken from other sources). Housed in a photo-album.
120. Kuroda, P. K. The Equilibrium Between Radon and its Decay Products in the Waters of Hot Springs National Park, Hot Springs, Arkansas. ; 1950. 8 p.

Report on a study of the equilibrium between radon and its decay products.
121. Kuroda, P. K. Tables of the Radioactivity of Natural Waters. : University of Arkansas, Institute of Science and Technology; no date. 58 p.
Tables of data from waters all over the world, including Arkansas Hot Springs (p. 26-28).
122. Kuroda, P. K.; Damon, P. E.; Hyde, H. I. Radioactivity of the Spring Waters of Hot Springs National Park and Vicinity in Arkansas. American Journal of Science. 1954 Feb; 252: 76-86.
New measurements of radioactivity of the hot spring waters and comparison with previous results. Includes tables of Radon and water temperature data.
123. Kuroda, P. K.; Meason, J. L., Department of chemistry, University of Arkansas, Fayetteville. Preliminary Report on the August 1960 Field Study of the Radioactivity of the Waters of Hot Springs National Park, Arkansas. ; 1960 Aug 22. 2 p.

Brief summary with two tables of data - water temperature and radon content of drinking water.

124. Kuroda, P. K.; Yokoyama, Yuji. Determination of the Short-Lived Decay Products of Radon in Natural Waters. *Analytical Chemistry*. 1954 Sep; 26: 1509-1511.
Note: Reprint.
Primarily a description of analytical techniques, but there is one table with a figure for "Natural radioactivity of Rainfall Observed" at Hot Springs, AR.
125. Lamb, T. E.; Barks, C. S. Progress Summary for Hot Springs Flow Project 1990 Water Year.
Series of progress reports on USGS thermal water monitoring project. Includes data on reservoir elevation, and "outflow weir discharge in gallons per minute".
126. Land Classification Map. Holmes, B. V. ; 1977 May. 1 sheet; 1"=1000'.
Map of the park with sections hand colored to indicate natural zone, historical zone, development zone, private development and landscape management.
127. Langdon, Keith. Untitled: Rare plant memo. . 1982 May 17. 3 p.
Memorandum referring to "what is probably the rarest plant in the park, Grave's Splenwort Fern (*Asplenium x gravesii*)". Suggests keeping its location confidential. Attached are photocopies of close-up photographs. (In the same file are the original photos).
128. Laughlin, Kendall. *Tilia relictia* laughlin Hot Springs Basswood. *Phytologia*. 1972; 24(4): 302-333.
Extensive description of a new tree species found in Whittington Park (the northwest part of the city of Hot Springs).
129. Laughlin, Kendall. Trees in the Hot Springs, Ark. District at the end of 1970. . 1970. 1 p.
Note: Poor photocopy.
List of trees. Some have dimensions.
130. Lee, Larry J. Structural Analysis of the Mazarn Synclinorium. Columbia: University of Missouri; 1965 Jun. 57 p.
Note: Photocopy. Held together with a clip.
Description of rock formations in the Mazarn synclinorium, "a northeast-southwest, elongate, basin situated in portions of Garland and Hot Spring Counties, Arkansas."
131. Lindahl, J. C. Trees of Hot Springs National Park and Vicinity. *Natural History Journal* (Hot Springs Natural History Association). 1938; 4.
Note: Stapled pages.
Listing of tree species found in the park with information about the species.
132. Lix, H. W. Birds of Hot Springs National Park and Vicinity. . 1937 Jan 20. 11 p.
List of birds (common and scientific names) with a code indicating abundance and seasonality. "All observations except the ones marked were

made by Mr. H. W. Lix".

3. Lix, H. W. A Guide to the Geologic Features to be Found at Hot Springs National Park, Ark. . 1936 Oct 20. 7 p.
Guide to visible geologic features in the park.
134. McElwaine, Robert B., Consulting Mining Geologist. The Southern Club Rock Slide of April 25, 1966 prepared for Hot Springs National Park Service. . 1966 Jun 28. 9 p.
Note: Bound in a black binder.
Geologic study to determine the cause of a rock slide that demolished part of the Southern Club building. Describes the nature of the rock material, explains the cause of this slide, anticipates future slides, and makes recommendations for preventing future slides.
135. Meyer, Richard L., Professor, Department of Botany and Bacteriology. A Qualitative Evaluation of the Algae Associated with the Springs and Formations in Hot Springs National Park. . 1981 Aug 5. 27 p.
Note: 1 copy bound in a blue folder, another unbound.
Report describing algae found in hot springs. Includes a list of species and their temperature tolerance.
136. Miser, Hugh D.; Purdue, A. H. Geology of the De Queen and Caddo Gap Quadrangles, Arkansas. Washington DC: US Geological Survey; 1929. 195 p. (Bulletin 808).
Index lists references sedimentation at Hot Springs on pages 128, 131, 132, and references to uplift and erosion in the Hot Springs area on pages 144-146.
137. Moore, Jewel E. Checklist of the mosses of Hot Springs National Park---1984. . 1984. 4 p.
Note: Stapled pages. Two cover letters attached to front.
List of moss species.
138. Name of Computer File. ; Month(s) Day(s), Year(s). # megabytes.
Note: Descriptive information about the document itself (Condition/legibility, misspellings in the title, whether attached to other documents. , etc...) If this is a citation only, describe here where the citation was found.
Summary of contents.
139. National Oceanic and Atmospheric Administration (NOAA). Climatological Data. 1976.
Includes data from Hot Springs National Park and Arkansas Post National Historic Site on air temperature and precipitation.
140. National Park Service. General Management Plan Development Concept Plan Hot Springs National Park Garland County, Arkansas. ; 1986 Jun. 105 p.
Section on natural resource management includes discussion of a plan to protect the springs' recharge area from development, revegetation of formerly developed land, avoid being susceptible to flooding.
1. National Park Service. Hot Springs National Park Bathhouse Row and Vicinity General Management Plan. ; 1978 Oct. 50 p.
Brief document which focuses on bathhouse row with a one-page description

of the need to keep the "hinterlands" as natural as possible.

142. National Park Service. NPS - PHS Water Supply Information system Chemical Analyses Report. . 1988. 1 page.
Note: Photocopy.
This sheet contains a table of chemical data for Whittington Ave Spring. It gives amount in mg/l, "comply" (yes or no), date and record number. There is no accompanying documentation to explain the source of this data.
143. National Park Service, Southwest Regional Office. Subject: Trip Report - Radon Daughter Concentration Measurements at Hot Springs National Park, Arkansas. . 1976 Mar 9. 8 p.
Memorandum discussing past and current radon and thoron measurements, with reasons for variation and assessment of health hazard.
144. National Park Service, Southwest Regional Office. Subject: Radon and Thoron Daughter Radiation Measurements at Hot Springs National Park. . 1976 Apr 30. 16 p.
Memorandum discussing past and current radon and thoron measurements, with reasons for variation and assessment of health hazard. Includes tables of data.
145. National Park Service, W.P.A. The Vegetation Type Survey of Hot Springs National Park. San Francisco, CA: National Park Service, Branch of Forestry, C.C.C. W.P.A. O.P. 705-3-5; 1937. 21 p.
Note: Fordyce Library copy is hardbound with green cover. Title on spine: Hot Springs National Park Vegetative Type Survey 1937-1939. Resource Management Library copy is bound in dark green paper.
Description of fieldwork followed by map keys (symbols representing species, color codes for vegetation types, acreage covered by various species, and the maps themselves (2 maps, folded and bound into the book. One is "Hot Springs National Park Arkansas Vegetation types Map, scale is 1 inch=400 feet. 5 vegetation types are colored in and smaller areas are delineated with symbols for dominant species. The other map is "Reference Map for Vegetation Type map of Hot Springs National Park Arkansas". This map has the same plant species designations, but no colored areas for vegetation types. Blue and orange circles give locations of sample plots and photograph sites.
146. Nettleton, Wesley A.; Parker, Keith A. Biological Evaluation of Southern Pine Beetle on the Hot Springs National Park, Arkansas. : US Forest Service, Southern Region; 1986 Jul; Report No. 86-2-19 3430 Alexandria Field Office. 13 p.
Note: Clipped together with the Hot Springs southern pine beetle management plan.
Results of a biological evaluation of southern pine beetle infestation undertaken in 1986 (during an epidemic). Includes a map showing active and inactive spots, an explanation of concerns and recommendations for control measures.
147. Noguchi, K. Geochemical Studies of Hot Spring Waters at Hot Springs Nat. Park, Ark. . 1953. 8 p.
Note: Unpublished report. Citation found in "The Origin of the Thermal Water at Hot Springs, Arkansas".

1. Noguchi, Kimio. Geochemical Nature of Hot Spring Waters in Hot Springs National Park of Arkansas. J. Balneological Soc. Japan. 1982; 33: 77-82. Found correlations between various chemical characteristics of the hot springs water (e.g. calcium and biocarbonate contents). Discusses the implications for the origin of the water. Also measured nitrogen, and carbon dioxide in gases emitted from the hot springs.
149. Noguchi, Kimio. Variation of the Radon Content in Two Display Springs and the Reservoir of the Hot Springs National Park in Arkansas. . 1982 Sep 10; 33: 83-92.
Note: This is a reprint. The name of the journal is printed in Japanese. Results of daily examination of the display hot springs: rate of flow, water temperature, radon, free carbon dioxide, calcium and magnesium, alkalinity and bicarbonate.
150. Ogra, M. S.; Sims, A. C. Aquatic Resources of Gulpha Gorge Creek Hot Springs National Park, Arkansas: Final Report on Chemical and Microbiological Analysis. New Orleans, LA: Southern University in New Orleans; no date (197?). 61 p.
Note: Stapled pages. Contract No. CX-700040186.
Analysis of water quality of Gulpha Gorge creek. Found good quality and no indication of contamination from human campers or hikers. Parameters measured were color, conductivity, dissolved oxygen, pH, temperature, turbidity, acidity, alkalinity, chloride, chromium hexavalent, copper, fluoride, hardness, iron, lead, manganese, mercury, nitrogen, phosphate, silica, sulfate & sulfide, suspended solids, and coliform bacteria. At the end is a list of plant species found along the creek and recommendations for future research.
151. Owen, David Dale, Principal Geologist. Second Report of a Geological Reconnaissance of the Middle and Southern Counties of Arkansas. Made During the Years 1859 and 1860. Philadelphia: C. Sherman & son, Printers; 1860. p. 8, 18-26, 101-104, 292-294, 341-342.
Note: Photocopy of these pages only. Bound in a blue folder with several other reports. Label on front of folder reads "The Elevated Country (between the Missouri & Red Rivers) Lead Mines of Missouri Geological Reconnaissance of Arkansas".
Description of the geology of the area and of the hot springs by an early observer. Includes a chart giving temperatures for each hot spring and some water chemistry data.
152. Palmer, E. J. The Ligneous Flora of Hot Springs National Park and Vicinity. Journal of the Arnold Arboretum. 1926; 7: 104-135.
Note: Printed on 8½ x 14" paper with a tattered green cover. Slipped inside a tan folder.
Discussion of the area followed by an annotated list of plant species.
153. Pearson, F. J.; Bedinger, M. S.; Jones, B. F. Carbon-14 Ages of Water from the Arkansas Hot Springs. : US Geological Survey; 1972. 12 p.
Note: Stapled pages. Front page is an "Abstract-Index Sheet".
Results of analysis of carbon in the hot springs water. Describes the carbon-related water chemistry and the age of the water determined by carbon isotope analysis.

154. Pfenninger, D. U. Untitled: forbs checklist. . 1990. 11 p.
Handwritten not clipped to this reads "this is an updated list of the forbs with some duplicate references deleted and some references that were not listed in Smith's Atland & the reference was just for the vicinity not the park".
155. Plat No 1 Sec'n of Hot Springs Mountain Hot Springs Ark. under the direction of First Lieut. Robert R. Stevens U.S. Army, Army and Navy Hosptal Grounds. Stevens, Robert R. : US Army; 1892 Nov 7. 1 map; 1" = 25'.
Note: Oil Cloth map encased in mylar. Cataloged in park's ANCS database. DSC microfilm number: DSC 128/60206. White oilcloth topographical map. Markings on map show large, medium and small deciduous trees, large and small coniferous trees, tufa, sandstone, under-ground sand stone, loose rock and "trees to be reserved".
156. Plat No 1 section of West Mountain Hot Springs, Ark. Cartographer unknown. ; 1892. 1 map; 1" = 25'.
Note: Oil Cloth map encased in mylar. Cataloged in park's ANCS database. Very similar to other maps done by Stevens, Robert R. in 1892. White oilcloth topographical map. Markings on map show large deciduous trees, large coniferous trees, and sandstone.
157. Plat No 2 Sec'n of Hot Springs Mountain Hot Springs Mountain Hot Springs Ark. under the direction of First Lieut. Robert R. Stevens U.S. Army, Army and Navy Hosptal Grounds. Stevens, Robert R. : US Army; 1892 Nov 7. 1 map; 1" = 25'.
Note: Oil Cloth map encased in mylar. Cataloged in park's ANCS database. DSC microfilm number: DSC 128/60134. White oilcloth topographical map. Markings on map show large, medium and small deciduous trees, large and small coniferous trees, tufa, sandstone, under-ground sand stone, loose rock and "trees to be reserved".
158. Plat No 2 section of West Mountain Hot Springs, Ark. Cartographer unknown. ; 1892. 1 map; 1" = 25'.
Note: Oil Cloth map encased in mylar. Cataloged in park's ANCS database. Very similar to other maps done by Stevens, Robert R. in 1892. White oilcloth topographical map. Markings on map show large deciduous trees, large coniferous trees, and sandstone.
159. Plat No 5 section of West Mountain Hot Springs, Ark. Cartographer unknown. ; 1892. 1 map; 1" = 25'.
Note: Oil Cloth map encased in mylar. Cataloged in park's ANCS database. Very similar to other maps done by Stevens, Robert R. in 1892. White oilcloth topographical map. Markings on map show large deciduous trees, large coniferous trees, and sandstone.
160. Purdue, A. H. The collecting area of the waters of the hot spirngs, Hot Springs, Ark. Jour. Geology. 1910; 18: 279-285.
Note: Photocopied pages.
Discussion of the regional geology and conclusions about the area which probably serves as a collecting unit for the waters which eventually emerge in th hot springs.
1. Purdue, A. H.; Miser, H. D. Geologic Atlas of the United States Hot Springs Folio Arkansas. Washington DC: US Geological Survey; 1923. 10+ p.

(Hot Spring Folio No. 215).

Note: DSC microfilm number 128/60386.

Headings: Topography (surface features, drainage, culture); Sedimentary rocks (stratigraphy); Structure (folding, faulting, metamorphism); Igneous Rocks (Potash Sulphur Springs area, area at the mouth of Gulpha Creek; Dikes and Sills, Time of Intrusion); Geologic History (Paleozoic Era, Mesozoic Era, Cenozoic Era); Economic Geology (mineral resources, water resources. Includes a chart showing stratigraphy, a topography map (1:62500 scale), a geology map, a structure sections map and a page with 8 black and white photographs of surface geology.

162. Reed, Mark, County Forester. Urban Forest Plan for Hot Springs National Park = Urban Forest Plan for the city at Hot Springs National Park. : Arkansas Forestry Commission; 1984 Dec 19. 25+ p.

Note: Bound in a lime green folder. The words "the city at" are handwritten as part of the title on the title page.

Recommendations to maintain and improve the natural and human-introduced vegetation in the business area of Hot Springs. At the end of the report are hand-drawn maps showing areas referred to in the report.

163. Rickett, John. Status and Distribution of the Ouachita Madtom (Noturus lachneri). ; 1986 Dec 19. 20+ p.

Report on the health and distribution of the Ouachita madtom (a fish) in the Saline River, Saline County Arkansas. Not in Hot Springs National Park, but in the neighboring county.

- Rowland, Eron, Historian of the Mississippi Society of Colonial Dames in America. Life, Letters and Papers of William Dunbar of Elgin, Morayshire, Scotland, and Natchez, Mississippi Pioneer Scientist of the Southern United States, Compiled and Prepared from the Original Documents for the National Society of Colonial Dames in America. : Press of the Mississippi Historical society; 1930: 142, 144, 146, 148, 161, 269-300. 410 p.

Note: Hardbound with green cover.

Page numbers taken from index under heading "Hot Springs". Description of exploration of the hot springs. Mentions plants and animals and the hot springs themselves.

165. Saugey, David A.; Saugey, Dianne G.; Heidt, Gary A.; Heath, Darrell R. The Bats of Hot Springs National Park, Arkansas. Proceedings Arkansas Academy of Science. 1988; 42: 81-83.

Note: Photocopy.

Report based on a survey of bats conducted in 1982-1987. Found 6 species of bats. See also data sheets (with species, sex, lactating status, weight and age) bound in 3-ring black binder labeled "HOSP RES ARCH", kpet on fourth shelf in natural resource library.

166. Schlundt, Herman. Electroscopic Determination of the Radium Present in some "Tufa" Deposits from Hot Springs, Ark. . 1907. 5 p.

Note: Photocopied pages. "A paper read by title at the Twelfth General Meeting of the American Electrochemical Society at New York City, October 18, 1907".

Describes laboratory analysis of Hot Springs tufa deposits. Includes data - radium per gram of tufa.

167. Schlundt, Herman. Report on the Radioactivity of the Spring Waters in the

Hot Springs National Park, Hot Springs, Arkansas. . 1933. 13 p.
 Note: Bound in a dark grayish-blue folder. See also published version, "Report on the Radioactivity of the Spring Waters on the Hot Springs Reservation, Hot Springs, Arkansas".
 Describes results of measurements of radioactivity of hot springs waters. Includes a table of data (spring name and radioactivity measures).

168. Schlundt, Herman. Report on the Radioactivity of the Spring Waters on the Hot Springs Reservation, Hot Springs, Arkansas. American Journal of Science. 1935 Jul; 30: 45-50.

Note: Fragile. See also manuscript version, "Report on the Radioactivity of the Spring Waters in the Hot Springs National Park, Hot Springs, Ark.".

Measured radioactivity of water from 45 springs. Found radon in all in widely varying amounts. Radium was found in some tufa deposits. Also measured pH. Includes 3 brief tables giving radon, radium and pH data.

169. Schoolcraft, Henry R., Corresponding Member of the Lyceum of Natural History of New-York. A View of the Lead Mines of Missouri; including some observations on the mineralogy, geology, geography, antiquities, soil, climate, population, and productions of Missouri and Arkansas, and other sections of the western country accompanied by three engravings. : Charles Wiley & Co.; 1819. 258-262.

Note: Photocopy of these pages only. Bound in a blue folder with several other reports. Label on front of folder reads "The Elevated Country (between the Missouri & Red Rivers) Lead Mines of Missouri Geological Reconnaissance of Arkansas".

Description of the geology of the area and of the hot springs by an early observer.

170. Scully, Francis J. Ferns of Hot Springs National Park and Vicinity. American Fern Journal. 1937 Apr; 27(2): 59-62.

Note: Photocopy.

List of fern species with brief not on habitat.

171. Scully, Francis J. Ferns of Hot Springs National Park and Vicinity. Natural History Journal (Hot Springs Natural History Association). 1939; 5.

Note: 2 bound copies, 1 unbound.

Annotated list of fern species collected in the Hot Springs National Park area. Includes some drawings.

172. Scully, Francis J. Grasses of Hot Sprngs National Park and Vicinity. Natural History Journal (Hot Springs Natural History Association). 1937; Supplement Number 1.

Information about grass species found in the park. At the end is a simple listing of 63 speces "which have been collected in Hot Springs National Park and vicinity on which the identifications have been checked and verified by the Smithsonian Institution.".

173. Scully, Francis J. Grasses of Hot Sprngs National Park, and Vicinity. Rhodora. 1942 Feb; 44.

Single page with list of species names.

174. Scully, Francis J. The Mosses of Hot Springs National Park and Vicinity.

The Bryologist. 1941 Oct; 44: 125-128.
List of species and habitats.

175. Scully, Francis J. Sedges and Rushes of Hot Springs National Park and Vicinity. Torreyia. 1942 Sep; 42: 129-130.
Note: Reprint.
List of sedges and rushes found during a survey of Hot Springs National Park. Scientific names only.

176. Sealander, John A.; Polechla, Paul J., University of Arkansas. A Small Mammal Survey of Hot Springs National Park, Arkansas Final Report. : Prepared for the Department of Interior Eastern National Park and Monument Association and National Park Service, Hot Springs National Park; 1981 Nov. 37 p.
Discussion of methods and an annotated list of small mammal species found in Hot Springs National Park. Checklist includes species documented in the past with the date and name of observer. Proposal is in natural resource vertical files.

177. Soil Conservation Service. Soil Survey of Garland County, Arkansas. ; 1989 Dec. 154 p. + 43 maps.
Standard soil survey report with information about soil use, soil properties, soil classification and soil types along with maps which consist of faint aerial photographs covered with lines indicating delineations of soil types.

- .. Sorrells Research Laboratory and Field Services. Laboratory Analysis. ; 1992. 4 p.
Data on thermal waters: arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, silver, sodium, corrosivity, chloride, color, copper, iron, manganese, pH, sulfate, dissolved solids, zinc, alkalinity, calcium, conductance, hardness, potassium, pesticides, radium, radioactivity.

179. Southard, Rodney E. Flood of May 19-20, 1990, in the Vicinity of Hot Springs, Arkansas. Little Rock, AR: US Geological Survey; 1992. 30+ p. (Water-Resources Investigations Report 92-4007).
Documentation of a flood which occurred on May 19-20, 1990 after severe thunderstorms. Gives precipitation and discharge data.

180. Stearns, Norah D.; Stearns, Harold T.; Waring, Gerald A. Thermal Springs in the United States. : US Geological Survey; 1937. (Geological Survey Water-Supply Paper 679-B).
An index in the back lists references to Arkansas Hot springs on p. 78-80, 117. P. 78-80 includes a description of the hot springs. P. 117 is part of a table which gives name, location, geology, temperature, discharge rate and remarks for each spring.

181. Steele, Kenneth F. Feasibility of Returning a Portion of the Hot Springs to Natural Discharge - Geological Aspects. . 1981 Oct. 12 p.
Note: Bound in a blue folder. Date is handwritten on title page.
Discussion of the feasibility of returning springs to natural discharge and the potential impact on tufa. Describes current, ongoing tufa formation.

182. Stone, Charles G.; Bush, William V. Guidebook to the Geology of the Eastern Ouachita Mountains Arkansas. Little Rock, AR: Houston Geological Society; 1982 Apr.
Description of exposed rock formations including 4 in the area immediately surrounding Hot Springs, AR: Polk Creek Shale and Bigfork Chrt at Hog Springs, Quarry in Bigfork Chert at Hot Springs, and Lower Stanley Shale East of Hot Springs. Includes maps of these sites.
183. Stone, Charles G.; Haley, Boyd R.; Viele, George W. Guidebook to the Geology of the Ouachita Mountains, Arkansas. Little Rock, AR: State of Arkansas Arkansas Geological Commission; 1973. 113 p.
Geologic fieldtrip book which includes Hot Springs National Park.
184. Swann, Sandra Kay, Henderson State University Arkadelphia, Arkansas. The Hot Springs of Hot Springs National Park, Arkansas: An Overview. . 1981 Jul 1. 20+ p.
Note: Bound in a yellow folder.
Description of the geologic events that created the hot springs, written in non-technical language. Section titles: Geology of the Area; Age, Source & Movement of Waters; Flow, Temperature & Composition of Waters.
185. Tankersley, James Carl. Thermophilic Blue-Green Algae in Hot Springs National Park. : East Texas State University; 1970 Aug. 63 p.
Note: Photocopy bound in a brown folder.
"Purpose of the Study: to survey the two open (display) springs; to confirm the presence of Phormidium releasei Gomont; to examine the springs for other algae present; to benefit the public, science, and the City of Hot Springs by correcting some of the outdated and erroneous information currently being disseminated about the Hot Springs by the United States Park Service." Includes lists of algae species found.
186. Taylor, W. Carl, Southern Illinois University. A checklist of the ferns and fern allies of Hot Springs National park and surrounding Garland County, Arkansas. . 1990. 2 p.
Note: Printed on green paper. Some handwritten notes on second page.
List of scientific fern names.
187. Taylor, W. Carl, Curator of Vascular Plants Milwaukee Public Museum. Ferns of the Tufa Deposits on Hot Springs Mountain, Hot Springs National Park: Inventory, Status, and Maintenance. Philadelphia, PA: Eastern National Park & Monument Association; 1981 Aug 1. 40+ p.
Results of a survey of ferns found on the limestone tufa deposits of Hot Springs Mountain in June of 1981. Includes a description of the distribution of the 6 species found, and a map showing this distribution, and photographs which are poorly reproduced. Also gives management recommendations.
188. Trimble, Carolyn Abbott. Absolute Counting of Alpha Decay and the Radioactivity in Water From Hot Springs National Park. : Northeastern State College; 1968. 56 p.
Study of radon in the thermal water of Hot Springs National Park with analysis of radon loss with various measurement techniques (used this to explain differences in results of past studies).

189. Trott, Wesley, Hot Springs High School Student. A Study of the effects of Radiation and Temperature surrounding the hot springs in Hot Springs National Park, Arkansas. . 1978 Nov 6. 36 p.
Note: Fordyce copy is missing the title page and consists of loose pages held together with a yellow plastic cover a newspaper article tucked into this report describes the author who won a scholarship based upon this research. Natural resource library copy is a photocopy.
Measured ground temperatures and radiation levels at the surface and mapped them. (The bulk of the report is a summary of past research and findings).
190. Uncontrolled Photo-mosaic Hot Springs and Surrounding Area Garland County. Hot Springs National Park. : Arkansas State Highway Department Surveys Division Photogrammetry Section; 1974 Jan 29. 1 sheet; 3' x 4' (approximate); 1"=2000'.
Black and white aerial photograph of the Hot Springs area.
191. Untitled: Fire History Map. Hot Springs National Park.
Base map of park with overlays indicating location and class of fires in the 30s, 40s, 50s, 60s, 70s, 80s and 90s.
192. Untitled: Hot Springs National Park Trails. Hot Springs National Park.
Mylar sheet showing trails in the park.
193. Untitled: LANDSAT 1-ERTS infrared photograph. NASA. : EROS data image (probably); 1974 Feb 19. 1 sheet; 3' x 3' (approximate); 1:2500 (approximate).
Color infrared satellite photograph of an 88 x 88 square mile area which includes Little Rock & Hot Springs. Shows geologic features and looks pretty.
194. US Army Corps of Engineers Vicksburg District. Initial Project Management Plan Flood Control Study: Ouachita River Basin Hot Springs, Arkansas. : US Army Corps of Engineers; 1991 Apr. 50+ p.
Note: Bound in red plastic folder with clear front.
Description of the flooding problem in downtown Hot Springs and plans for flood control.
195. US Army Corps of Engineers, Vicksburg District. West Mountain Hydrogeologic Investigation Hot Springs National Park Garland County, Arkansas, Environmental Assessment. : US Army Corps of Engineers; 1993 May. 30+ p.
Environmental assessment for a proposed project to drill wells within the park to get information which will help determine the feasibility of constructing a flood control tunnel through West Mountain.
196. Werth, Charles R.; Taylor, W. Carl. Asplenium x gravessi Discovered in Arkansas. American Fern Journal. 1980; 70(1): 28.
Note: Single page.
Two paragraph description of the discover of this rare hybrid fern.
197. Winderlin, Debbie; Harris, Donny. Report to National Park Service Hot Springs National Park Hot Springs National Park. . 1993. 11+ p.
Note: Stapled pages.
Draft report on progress on a study of the effect of human development on

wild turkeys (*Meleagris gallopavo silvestris*). Includes a map of observation sites and a plan/schedule for future work.



United States Department of the Interior

NATIONAL PARK SERVICE
AIR QUALITY DIVISION
P.O. BOX 25287
DENVER, CO 80225

IN REPLY REFER TO:

September 1, 1993

N3615(475)

Memorandum

To: Bob Krumenaker
Air Quality Coordinator
Southwest Regional Office

From: Erik Hauge *Erik R. Hauge*
Environmental Specialist
Policy, Planning and Permit Review
Air Quality Division

Subject: Hot Springs National Park (HOSP) Draft
Statement (HOSP-N-015.000)

*Cops sent
to Park
11-15-93*

The Air Quality Division (AQD) has reviewed the HOSP draft air quality project statement. We offer the following comments.

The Problem Statement describes the park's air quality being affected by air pollution from both mobile and stationary sources in its urban setting. In addition, the park's visibility is sometimes impacted by major nearby controlled burn operations in the fall and spring. No air quality or visibility monitoring is currently being conducted at the park. The Description of Recommended Project or Activity calls for, among other things, the establishment of a visibility monitoring program at the park with AQD assistance.

A comprehensive park visibility monitoring program should include a transmissometer and/or a nephelometer, an automated camera, and a fine particulate sampler. The total capital and installation cost for that array of instruments is \$99,800. Contractor assistance is an additional \$78,000. Park support of 0.22 FTE would be required. I have attached some material which briefly describes the various elements of a visibility monitoring program. The material also includes the costs of air quality, acid precipitation, and meteorological monitoring, which, when added to the visibility monitoring, would fully characterize the air quality and visibility in a park.

Air quality monitoring for particulates and gases is being conducted in the vicinity of HOSP and in the Little Rock area. This includes fine particles (PM-10) at Hot Springs, ozone at DeGray Lake, and ozone and total suspended particles at a ranger station in Ouachita National Forest, as well as PM-10, sulfur dioxide, ozone, carbon monoxide, nitrogen dioxide, lead and total suspended particles at various monitoring stations in and around Little Rock. Data from the nearby monitors should help characterize the HOSP air quality. I suggest that park staff contact Mr. J.B. Jones, Chief, Division of Air Pollution Control, Arkansas Department of Pollution Control and Ecology, 8001 National Drive, Little Rock, AR 72209 (telephone 1-562-7444) for further information regarding air quality monitoring (and resulting data) in the vicinity of HOSP.

The cost of establishing a comprehensive visibility monitoring station at HOSP may be prohibitive. Because the AQD monitoring budget has been cut back, we cannot provide funds at this time to assist the park in this effort. However, we suggest that the park may choose to develop a visibility program in phases. First, the data from the fine particulate monitor in Hot Springs should be representative of the park. The park would not have to install its own aerosol monitor. Second, park staff should begin to take 35 mm slides from observation sites like Hot Springs Mountain Tower to record changes in scene characteristics such as contrast, color, texture, and clarity. For assistance in establishing a photographic documentation program, I suggest that park staff contact Mr. David Dietrich at Air Resources Specialist, Inc. (an NPS contractor) in Fort Collins, CO (address and telephone number is included in the attachments). The option of installing and operating optical measuring instruments should be discussed in the future after implementation of the earlier phases.

I have also attached a marked-up copy of the draft project statement where it should be rewritten. If the park staff would like further clarification or further information, they can call me at (303) 969-2078.

Attachments

cc:
HOSP: Supt.

Visibility Monitoring Approaches

Technical Note 92-201



Introduction

Protection of the visibility resource in Class I wilderness areas, rural areas, and urban areas is an important issue. A variety of monitoring techniques exist to document visibility conditions and to make quantitative measurements of the atmospheric properties that affect visibility. The IMPROVE Program (Interagency Monitoring of Protected Visual Environments) has partitioned visibility-related characteristics and measurements into three groups:

Optical: the ability of the atmosphere to scatter or absorb light passing through it. The physical properties of the atmosphere are described by extinction, scattering and absorption coefficients, plus an angular dependence of the scattering, known as the scattering phase function. Optical characteristics integrate the effects of atmospheric aerosols and gasses. Commonly applied optical monitoring instruments include transmissometers and nephelometers.

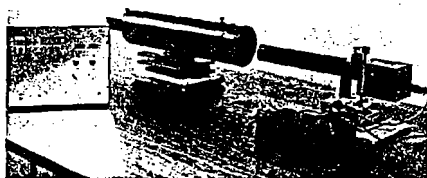
Scene: the appearance of a scene viewed through the atmosphere. Scene characteristics include observer visual range, scene contrast, color, texture, clarity and other descriptive terms. Scene characteristics change with illumination and atmospheric composition. Photographs are an effective way to document scene characteristics.

Aerosol: the physical properties of the ambient atmospheric aerosols (chemical composition, size, shape, concentration, temporal and spatial distribution and other physical properties) through which a scene is viewed. Fine particle measurements are commonly made to quantify aerosol characteristics.

The techniques most appropriately applied in a monitoring program depend on monitoring objectives and budget considerations. Air Resource Specialists, Inc. (ARS) can help you plan and develop your visibility monitoring and data analysis program. An overview of the variety of visibility-related air quality monitoring and analysis techniques supported by ARS is presented in this technical note.

Optical Monitoring

Transmissometer



ARS has been intimately involved with the development, implementation and operation of high-resolution, long-range transmissometers for visibility measurements. The Optec LPV-2 transmissometer, the only existing, operational long-range system, directly measures the ability of the atmosphere to transmit light. These measurements have an exact relationship to the total atmospheric extinction coefficient. ARS has developed the installation and operational protocols for the system and has installed and operated over 25 systems in class I areas and urban environments. ARS has also developed transmissometer analysis protocols and programs and provides a full range of system calibration and maintenance services. ARS is the recognized leader in transmissometer applications for visibility. A more complete description of transmissometer systems is provided in ARS Technical Note 92-204.

Visibility and Aerosols Monitoring

Visibility, in the most general sense, describes the effect that various types of aerosols and gases have on our ability to clearly see color and texture of objects and features in our field of view. The light scattering and absorptive properties of these aerosols and gases under different lighting conditions can impair the appearance of landscape features.

Regarding the effects of aerosols, two types of aerosols, primary and secondary, can contribute to visibility impairment. Primary aerosols are emitted from a source directly as particles, while secondary aerosols are formed from gaseous precursor emissions which react with other gases in the atmosphere to form particles. These reactions are complex and have only recently begun to be understood. Smoke from forest and prescribed fires, fly ash from the burning of coal, and wind blown dust are examples of primary aerosols. Ammonium sulfate and ammonium nitrate in air are examples of secondary aerosols. Naturally-occurring aerosols are mostly composed of nitrogen, oxygen, and some trace gases, along with water droplets, wind-blown dust, and secondary organic particles associated with biogenic emissions. Urban and industrial sources emit particles and gases such as fly ash, sulfur oxides, nitrogen oxides, and hydrocarbons. The gases begin to convert to aerosols of various composition and sizes immediately after they are emitted. Sulfur and nitrogen oxides convert into sulfate and nitrate aerosols, and hydrocarbons become organic aerosols.

A comprehensive visibility monitoring program to determine existing visibility conditions and to identify and quantify the causes of visibility impairment includes both atmospheric optical and particulate concentration measurements. Monitoring methods can be subdivided into three classes: view, optical, and aerosol monitoring.

View monitoring, which consists of taking photographs to relate the effects that aerosols have on the appearance of landscape features, is the most simple and direct form of communicating visibility impairment. Therefore, a systematic photography program (view monitoring) that records the appearance of the scene under a variety of lighting conditions and aerosol concentrations is a key part of most visibility monitoring programs.

However, because it is difficult to extract quantitative information from color slides or pictures, some direct measure of a fundamental optical property of the atmosphere is also desirable. All visibility programs include some measure of either atmospheric extinction or scattering. Most monitoring programs use combinations of transmissometers and integrating nephelometers to measure these two parameters.

The other element of a fully complemented monitoring site, aerosol monitoring is generally made in conjunction with optical measurements to help infer the cause of visibility impairment, and to estimate the source of visibility reducing aerosols. The two dimensions of particle characterization most often used in visibility monitoring programs are size and composition. Particles between 0.1 and 1.0 micrometers (μm) are most effective on a per mass basis in reducing visibility. Particles of this size also tend to be associated with man-made emissions. Chemical speciation of the particles helps determine their chemical-optical characteristics and their ability to absorb water

(relative humidity effects), and is important when trying to determine the origin of the aerosol. It is essential to measure relative humidity simultaneously with particle measurements as relative humidity influences the effect that hygroscopic aerosols have on visibility.

Particle monitoring systems currently being used by the NPS and EPA consist of four independent filter modules controlled by a common microprocessor system. Each of three fine particle modules (0.0-2.5 μm) has a dedicated inlet, cyclone, flow control device, and pump. The Module A teflon filter is used to measure fine mass, hydrogen, the elements sodium through lead, and the coefficient of optical absorption. Module B contains an acidic vapor diffusion denuder followed by a nylon filter and is used to measure nitrate ions. Module C contains tandem prefired quartz filters and is used to estimate organic and light absorbing carbon. A teflon filter in Module D is used to determine PM_{10} (0.0-10.0 μm) mass concentrations.

We recommend that, at a minimum, a camera system be used in conjunction with a particle monitoring system (including relative humidity measurements) to characterize the appearance of the scenic landscape features and, concurrently, characterize the aerosol composition responsible for the visibility degradation. This suite of measurements will allow a theoretical reconstruction of extinction and apportionment of visibility degradation to various aerosol species. Because theoretical estimations of extinction from aerosol measurements is not an exact science, it is also desirable to measure either the atmospheric scattering or extinction coefficient using the integrating nephelometer or transmissometer.

The capital cost of a camera, particle monitor, transmissometer, and nephelometer is \$75,300. The installation cost for the instruments is an additional \$24,000. Annual operating cost for the monitoring site is \$78,000 (for contractor assistance) plus park support of 0.22 FTE.

While the monitoring described above will determine current impacts on visibility and distinguish aerosol species responsible for the visibility impairment, it will not identify the sources contributing to each measured species. Additional analyses such as back trajectory, chemical mass balance, and empirical regression models will allow for estimation of the relative contribution of source types and, in some cases, will identify the location of those sources. These receptor-oriented approaches should be combined with deterministic modeling to develop a more thorough understanding of the frequency and duration of source impact.

The cost of source receptor modeling is on the order of one person-year, while deterministic modeling could vary anywhere from 1 to 5 person-years of effort. We would suggest that a monitoring system be initiated first, then, if necessary, a source-receptor approach be implemented, using data from the monitoring effort to develop an overall research plan.

NATIONAL PARK SERVICE
AIR QUALITY DIVISION
TYPICAL MONITORING PROGRAM COSTS PER PARK *

ITEM	CAPITAL COST	INSTALLATION COST	TOTAL CAPITAL/ INSTALLATION	ANNUAL OPERATING COST		TOTAL FIRST YEAR COST
				CONTRACTOR ASSISTANCE	PARK SUPPORT	
VISIBILITY MONITORING						
Nephelometer	\$25,000	\$5,000	\$30,000	\$24,000	0.10 FTE	\$54,000.00
Transmissometer	\$35,500	\$12,000	\$47,500	\$24,000	0.10 FTE	\$71,500.00
Camera (Qual. Analysis)	\$2,800	\$2,500	\$5,300	\$2,500	0.01 FTE	\$7,800.00
Fine Particle	\$12,000	\$5,000	\$17,000	\$27,500	0.01 FTE	\$44,500.00
CRITERIA POLLUTANT MONITORING						
Ozone	\$29,950	\$17,800	\$47,750	\$29,250	0.30 FTE	\$77,000.00
Filter Pack Sampling (Per pollutant: SO ₂ , NO ₂ , HNO ₃ , etc.)	\$6,000	**	\$4,000	\$4,000	0.01 FTE	\$10,000.00
WET DEPOSITION MONITORING						
	\$7,000	\$1,500	\$8,500	\$5,600	0.10 FTE	14,100.00
METEOROLOGICAL MONITORING						
	\$9,600	\$5,200	\$14,800	\$4,600	0.01 FTE	\$19,400.00
CONTINGENCY (10% INSTALLATION AND OPERATING COSTS)						
		\$4,750	\$4,750	\$10,985	0.04 FTE	\$15,735.00
TOTAL (with Nephelometer)						
	\$92,350.00	\$41,750.00	\$132,100.00	\$108,435.00	0.58 FTE	\$242,535.00
TOTAL (with Transmissometer)						
	\$102,850.00	\$48,750.00	\$149,600.00	\$108,435.00	0.58 FTE	\$260,035.00

* THESE COSTS ARE BASED ON HAVING ONE STATION

* THESE COSTS ARE BASED ON HAVING ONE STATION FOR CRITERIA POLLUTANT, FINE PARTICLE, AND METEOROLOGICAL EQUIPMENT; ONE CAMERA SITE; AND EITHER A TRANSMISSOMETER OR NEPHELOMETER SYSTEM. PARK SUPPORT COSTS ARE NOT INCLUDED.

** IF NO FINE PARTICLE SAMPLER IS IN PLACE, INSTALLATION COSTS WOULD BE \$5,000.

PROJECT STATEMENT SHEET

HOSP-N-015.000
PS Page: 0028

PROJECT NUMBER: HOSP-N-015.000

TITLE: AIR QUALITY

FUNDING STATUS: FUNDED: 0.00 UNFUNDED: 4.30

SERVICEWIDE ISSUES: N24 OTHER

CULTURAL RESOURCE TYPE CODE: N/A

10-238 PACKAGE NUMBER:

PROBLEM STATEMENT:

in areas already meeting the NAAQS

The ~~federal~~ Clean Air Act established National Ambient Air Quality Standards ~~for the nation~~ and set limitations on the amount of degradation that would be permitted. Mandatory Class I areas (basically national wilderness areas, national memorial parks over 5,000 acres, and national parks over 6,000 acres) ~~are permitted~~ Very little deterioration Class II areas (such as Hot Springs National Park) are permitted moderate air quality deterioration.

The park air quality is affected by the products of its urban surroundings: motor vehicle exhaust pollutants and gasses/particulates from ~~building heating systems~~. In addition, the surrounding commercial and private timber and pasture land managers conduct major controlled burn operations in the fall and spring, causing such smoke pollution that visibility of nearby mountains is sometimes completely lost.

The viewing of scenic vistas at West Mountain and the Hot Springs Mountain Tower ~~are~~ an important part of the ~~may~~ visitor's park experience. Currently, no baseline data ~~collection~~ ²¹² is collected on air pollution, ~~vista~~ visibility or other air quality related values.

DESCRIPTION OF RECOMMENDED PROJECT OR ACTIVITY:

Continue to monitor proposed industrial developments for their potential detrimental effects to the park's air quality. Provide input to the state, and the NPS Air Quality Division regarding park concerns. Work with the NPS Air Quality Division to document the visibility of distant landmarks from the Hot Springs Mountain Tower (or another important vista in the park) to provide a baseline, ~~on the park visibility~~.

BUDGET AND FTES:

-----FUNDED-----
Source Act Type Budget (\$1000s) FTES

Proposal Date: 91

PROJECT STATEMENT SHEET

HOSP-N-015.000

PS Page: 0029

Year 1:

Year 2:

Year 3:

Year 4:

Total:			0.00	0.0
			<i>* [See attached information.]</i>	
-----UNFUNDED-----				
	Source	Act Type	Budget (\$1000s)	FTEs
Year 1:	AIR-QUAL	MON	2.50	0.0
Year 2:	AIR-QUAL	MON	0.60	0.0
Year 3:	AIR-QUAL	MON	0.60	0.0
Year 4:	AIR-QUAL	MON	0.60	0.0
Total:			4.30	0.0

(OPTIONAL) ALTERNATIVE ACTIONS/SOLUTIONS AND IMPACTS: N/A

COMPLIANCE CODE(s): EXCL

EXPLANATION:

Proposal Date: 93